-Hill Publishing
Company, Inc.

December
1933

Construction Methods

CRANE ATTACHMENT on storage-battery truck sets spandrel forms at Riker's Island prison, New York City

SPECIFY DU PONT EXPLOSIVES!

REG. U. S. PAT. OFF.

FOR ROAD BUILDING

IF YOU are taking part in the Government's great road-building program or other projects in connection with highway construction, you will find the use of explosives necessary in various phases of your work.

Through the many years during which the du Pont Company has manufactured explosives it has steadily been improving its products and developing new types for definite purposes. These products have won world-wide recognition for their superiority, and can be supplied quickly in any part of the country.

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Explosives Department

Wilmington, Delaware

BRANCH OFFICES: Birmingham, Chicago, Denver, Duluth, Huntington, Joplin, New York, Pittsburgh, Scranton, Seattle.

WORK	BRANDS	INSTRUCTIONS FOR USING
THOROUGH CUTS	Du Pont Quarry Gelatin Red Cross Extra Red Cross Blasting Powder—Free Running R. R. P.	When cutting through a hill the explosive to select depends upon the nature of the rock and working conditions Quarry Gelatin for wet outside work; higher strengths for hard rock, and lower ones for soft rocks. If holes are not particularly moist, Red Cross Extra. For deep holes in fairly dry work, the Free Running Red Cross Blasting Powders are economical.
SIDE HILL CUTS	Du Pont Quarry Gelatin Red Cross Extra Red Cross Blasting Powder—Free Running Blasting Powder	Hard rock, Quarry Gelatin; softer materials, Red Cross Extra grades, or in dry work, Free Running Red Cross Blasting, or granular black powder. In working from the side, if excavated material is to be used for filling, loads should be barely heavy enough to break ground for convenient handling. In working from the end, rules for thorough cuts apply. Use same explosives.
EARTH SIDE HILL CUTS	Red Cross Extra —20% Red Cross Blasting Powder No. 2 — Free Running Blasting Powder	Loosen ground with light blasts for road machines, or hand digging. Blast trees, stumps and boulders from side and out-fall ditches. Widen and straighten cuts and blast down gravel with Red Cross Extra 20%, Red Cross Blasting No. 2 F. R., or blasting powder.
GRAVEL PITS	Red Cross Extra —20% Red Cross Blasting Powder No. 2 — Free Running	In blasting to obtain grading material, holes are spaced as for other blasting. If rock is not encountered, holes are loaded lighter, merely to loosen material for easy digging. Use Red Cross Extra 20% and Red Cross Blasting No. 2 F. R.
BOULDERS	Red Cross Extra —20%—40% Du Pont Extra D Agritol	For mudcapping, remove dynamite from shell, pack it in a conical heap on the boulder; insert cap and fuse, cover explosive with several inches of thick, heavy mud. Never lay stones on top of mudcap. For snake-holing, punch hole beneath and against boulder. Tamp charge compactly. Use Red Cross Extra 20% or 40%, du Pont Extra D, or Agritol where heavy soil under boulders provides required resistance.
QUARRYING	Red Cross Extra —40% Du Pont Extra Du Pont Quarry Gelatin Du Pont Gelatin Gelex	To crush stone for road building, use Red Cross 40%, du Pont Extra, Gelatin, or Gelex. Tamp holes well and fire simultaneously. For quarrying dimension stone, use blasting powder of fine granulation to start cracks and seams in desired direction. For extremely hard rock, du Pont Quarry Gelatin.
FILL SETTLEMENT	Du Pont Ditching Du Pont Gelatin —40%	Use dynamite for removing unstable material from roadbeds and to create cavities for the fill to drop into; also to stir up and liquefy mud surrounding the cavity to permit rapid settlement of the fill. Du Pont Ditching Dynamite is particularly effective, because of its water-resisting and propagating qualities. If necessary to place explosive under fill, use du Pont 40% Gelatin in large cartridges.
DITCHING	Du Pont Ditching Dynamite	Ditches can be blasted in wet soil by the propagation method; the electric method can be used in wet or dry soil. In wet soil, du Pont Ditching Dynamite, which blasts by propagation, effects economies in time, labor and money.
STUMPS	Red Cross Extra —40% Agritol Red Cross Extra —20% Loggers' Powder (Pacific States)	For blasting green, lateral rooted stumps, use 40% Red Cross. For tap-rooted stumps, Agritol, or, if soil is heavy, Red Cross Extra 20%; if light soil, Red Cross Extra 40%. Blast tap-rooted stumps out of light soil, with Red Cross Extra 40%. Du Pont Loggers' Powder for the Pacific Northwest.

Construction Methods

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ROBERT K. TOMLIN, Editor
Editorial Staff: Vincent B. Smith, J. I. Ballard (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald
WILLARD CHEVALIER, Publishing Director

A Drive for Winter Construction

● The Public Works Administration has started a determined drive to push winter construction to the limit. To this end, orders have been sent to all PWA state engineers, advisory boards and regional advisers instructing them to impress upon state, municipal and county officials the extreme necessity of continuing work on projects under way and of starting work on new projects wherever possible. The letter of instruction points out that winter construction, except in the most severe climate, is entirely feasible for many types of public works and requires only the willingness of the builder to carry out the job.

"It is essential," said Administrator Ickes, commenting on his plans, "that all interested in the effort to move men from relief rolls to pay rolls engage in a practical and widespread program of winter construction. Engineers in almost every branch of the construction industry have developed methods by which winter work can be carried on. It is our intention to encourage the use of these methods, where advisable, on all projects involving Public Works funds."

In severe northern climates there are certain types of work which cannot be continued throughout the winter because of high weather-protection costs. On the other hand, there is an abundant supply of approved projects in sections where winter weather is more moderate and where modern methods and equipment can readily be utilized to keep construction in progress during cold weather. This winter, the construction industry can not afford to hibernate.

Work Relief

● Quick employment of 4,000,000 men on work relief projects throughout the country this winter is the objective of the $400,000,000 Civil Works Administration program authorized last month to serve as a stop-gap until the full effect of the $3,300,000,000 public works program is felt. The civil works program, to be carried on under the direction of Relief Administrator Harry L. Hopkins, with funds allocated by the PWA, implies no lack of confidence in the public works program as a sound policy of support for industrial recovery, but rather a realization that the construction of substantial public improvements on a vast scale is not compatible with quick action and that because of the comparatively small amount of employment it has thus far produced the relief demands this winter will be heavier than those of last year. The plan proposes real jobs and real wages for a large proportion of those who would otherwise have to depend upon relief rolls.

The success of the civil works program as a method of creating bona fide employment for the destitute rests in the final analysis upon local authorities. Complete responsibility is vested in state and community divisional administrations whose personnel has been drawn to a large extent from existing relief administrative units appointed by Washington but familiar with local conditions. In developing useful work programs the civil works administrations are instructed to obtain the cooperation of regular operating departments in charge of highways, streets, water, sewage and other public services. Expenditures from the fund will cover tools and materials in addition to labor pay-rolls.

Pease, in the Newark Evening News

No Time for Strikes

ANNOUNCEMENT was made last month of the appointment of a Board of Labor Review for the Federal Emergency Administration of Public Works. Composed of three members representing the PWA, labor and contractors, under the direction of U.S. Senator Robert F. Wagner, chairman of the National Labor Board, it will hear all issues arising under the operation of construction contracts financed by public works funds, and its decisions will be binding on all parties. The efforts of this PWA board, together with those of the national board, should be effective in composing differences between employer and employee.

In commenting recently on the present-day labor situation Senator Wagner spoke wisely when he said: "The most important relationship in modern industrial life is between employer and employee. The conditions under which a man works increase his self-respect or push him toward degradation. The manner in which a man gives employment makes him an oppressor or a humanitarian. The satisfactory adjustment of this relationship in terms of wages is the greatest single factor in maintaining prosperity. Up to the present employers and employees have not acted in unison. Trained in the philosophy of conflict they have resorted to strife as the prime arbiter. It has fomented implacable hatreds and established the conditions for depression after depression. This warfare still exists to a deplorable extent. Evils of a century can not be thrown off in a day."

Don't Starve the Equipment Industry

● For well-meaning but misguided local officials who have been blindly advocating hand labor methods exclusively as a means of unemployment relief through construction, a timely warning comes from Thomas H. MacDonald, chief of the U.S. Bureau of Public Roads. Addressing the American Association of State Highway Officials recently, he said: "In the conduct of contract work we must steer a safe course between machine and hand methods. In the effort to provide increased employment on the highways there must be no destruction or starvation of the equipment industry or loss of industrial employment that should be generated by a widespread road-building program."

Road Builders To Meet

● With so many new problems arising in the field of highway construction, due to PWA regulations governing the conduct of the work, minimum wage scales, maximum hours of work and diversion of highway funds to other uses, unusual interest should center in the forthcoming annual convention of the American Road Builders' Association, to be held at the Stevens Hotel, Chicago during the week of Jan. 22. The main themes of the meeting, it has been announced, will be the continuation of an adequate highway program, federal participation in the highway program, the use of highway revenues for highway purposes only, and the recapture of diverted gasoline and motor vehicle taxes. An exhibit, housed in the same hotel as the convention and confined to booths, will offer highway engineers and contractors contact with the new or improved products of the manufacturers of equipment and materials.

NEXT MONTH—The January issue of "Construction Methods", appearing on the eve of the convention of the American Road Builders' Association at Chicago, will be the annual

ROAD BUILDERS' NUMBER

Uncle Sam Cannot Afford to Chisel

THE major purpose of NRA is to help industry to survive the current depression of trade. It seeks to prevent industry from committing economic suicide, to restrain it from trampling itself to death in a panic.

To accomplish this it imposes certain restrictions upon individual freedom. However much a man may want a job, it is unlawful for the time being for him to work for a wage lower than a prescribed minimum. However anxious he may be to increase his income, he may not work more than a specified number of hours per week.

These restraints are imposed to protect the many from exploitation because of the need, the greed or the fears of a few. Under these provisions the employer must not take advantage of the worker who might be willing in his distress to accept less than a living wage, thereby undermining the wages of all.

So much for labor. We know no employer who does not applaud this effort to maintain our living standards; all accept it as the reasoned program of a civilized people to insure self-preservation.

Now what of the employers? And what of those who supply the capital sinews of industry, those who have saved some of their earnings and invested them in the various forms of productive industry that are so necessary to provide employment for all? Real, honest dollars we mean; not the water-logged holdings of predatory speculators, who seek to reap where they do not sow.

No sane industrialist expects today a return on the inflated values of 1928, just as no sane worker expects the same income he then enjoyed. Both profits and wages have been sadly deflated; now our common task is to build them back to a level that will mean plenty for all. Meanwhile employer and employee will be content to get by. But both must have sufficient income to survive; otherwise our effort for recovery is a mockery.

The minimum wage guaranteed to labor is prescribed in each industry code. Through the provisions that bar selling below cost and require maintenance of published prices, each industry seeks to foster a minimum wage to capital that will prevent its starving to death before the advent of better times. And let us never forget that capital can be starved to death just as truly as can labor; and each is essential to the survival of the other.

But whatever each industry may do to prevent chiseling from within, it still is necessary to curb chiseling from without. It is grotesque for one producer to deplore chiseling by his customers when his own purchasing department connives at chiseling in another industry. The principles of NRA together with a copy of the Golden Rule should be pasted over the desk of every purchasing agent as well as over those of production and sales managers.

And whatever business men may do to foster fair practice between industries, it is obvious that for some months to come many industries must find their chief markets in the various governmental departments, federal, state and local. This is particularly true of construction equipment and other capital industries.

So if chiseling is to be curbed in these industries government buyers must do their part. So long as they encourage manufacturers to bid below cost or otherwise to cut corners in landing government orders, there probably will be some manufacturers so shortsighted, or so desperate as to do it. And however few those may be, it is perfectly possible in an industry operating at 15 to 25 per cent of capacity for them to destroy honest and conservative investment. If the producers in such industries are to help themselves, if they are to earn the revenues that will keep them alive and pay the taxes required to meet the salaries and other costs of government, it will be necessary for governmental buyers to refrain scrupulously from chiseling either values or prices and to cooperate for the common welfare.

If we would maintain a living wage for workers we must maintain a living wage for the capital that makes their employment possible; if we must protect the workers from chiseling by their weaker fellow-workers we must protect the employers from similar chiseling by their weaker fellow-employers; if we must have the cooperation of employers to protect labor, we must have the cooperation of customers to protect conscientious employers. *Every producer, after all, is someone's customer.*

Uncle Sam has made the rules under which industry must live and work during the emergency; it's up to Uncle Sam's employees to help industry to prosper under these rules.

Willard Chevalier

Publishing Director

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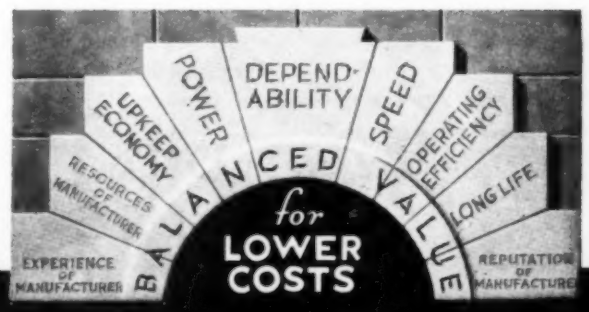
IF you operate an obsolete machine today, you are sacrificing up-to-date speed and ease of operation, you're gambling with expensive breakdown delays, and probably paying high upkeep and repair bills . . . in short, sacrificing your chance to make a profit.

You need an excavator that will enable you to get contracts, give you consistently high output, dig at the lowest possible cost per yard. Figure that new N. R. A. job on the basis of a modern machine selected for balanced value.

BUCYRUS-ERIE CO., South Milwaukee, Wisconsin



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See BUCYRUS ERIE before you buy!

He saw the point . .

and Cordeau gave him an extra profit

It happened on a highway job, about six miles outside of Wilkes Barre, Pa., in the beautiful hills of Luzerne County. The grade called for a long heavy side-cut containing 11,760 cu. yds. of rock. Contour of the ground sloped to the west, and the problem was to load and fire the shot so as to remove as much material as possible in this direction, and avoid handling.

The cut was approximately 400 yards long, with a total depth of 23 feet at its highest point. Original plans called for 121 well drill holes and 150 wagon drill holes, to be fired simultaneously with EB Cap and Cordeau. This plan would have removed only a portion of the rock, necessitating replacement of equipment several times before the cut could have been completed.

Mr. R. Mazzoni, the contractor, was persuaded to hook up the entire shot with Cordeau, and decided that, since there is really no limit to the number of holes that can be fired at one time with this detonating fuse, he would remove the entire cut in one giant blast.

Accordingly, the drilling was continued until a total of 1,186 holes had been made. There were 121 6" well drill holes averaging 24 ft. deep; 469 2½" wagon drill holes averaging 6 ft. deep; and 596 jackhammer holes averaging 6 ft. deep. A total of 23,750 lbs. of powder was used, and the hook up required 15,000 feet of Cordeau.

A perfect shot was obtained. Approximately 5,000 cu. yds. of rock was lifted clear of the right of way and deposited over the lower slope. This fact in itself was a big saving, justifying the use of Cordeau. In addition, however, was the fact that the shovels, air compressors, drilling equipment, pipe lines, tractors, etc., which under the old plan would have had to be removed *three* times, were able to remain in place until the entire blast was ready.

Frankly, only with Cordeau-Bickford Detonating Fuse would a giant blast such as this be practicable. The savings —the *extra* profit—were therefore due to the use of Cordeau. The Ensign-Bickford Company, Simsbury, Conn.

This book illustrates and describes a new technique in blasting that is saving thousands of dollars for quarry men and contractors everywhere. We'll gladly send a copy to any executive without charge.

CORDEAU
DETONATING FUSE
BICKFORD

For Sure-Fire economy *Safety Fuse*

Development of Safety Fuse has kept pace with modern engineering. For dry, damp, wet, or extremely wet work . . . whatever your specific requirements may be, they can be met with Ensign-Bickford Safety Fuse.

Nine famous brands are available:

GROUP I

Single Tape, gray—damp work
Double Tape, gray—wet work
Beaver, yellow—damp work
Crescent, white—wet work.

GROUP II
(burn more slowly than those in Group I)

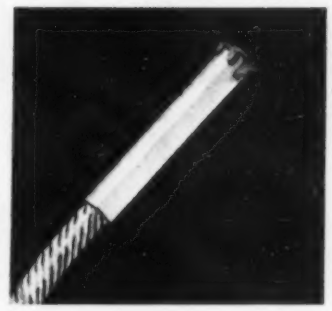
Clover, white—very wet work, little smoke
Clover, Orange Wax—very wet work, little smoke, changes appearance while burning
Charter Oak, white—damp work
Charter Oak Gray—very wet work
Charter Oak, Black Wax—very wet work.

We have been making Safety Fuse *up-to-date* for 97 years. The Ensign-Bickford Company, Simsbury, Conn.

This book *shows how to prevent blasting trouble through the proper care and use of Safety Fuse. Sent to executives without charge.*

SAFETY FUSE MATCH LIGHTER

A short paper tube that can be slipped over the freshly cut end of the fuse. One end of the tube is coated with the material that safety matches are made of. When you're ready to light the fuse, strike the tube with the edge of a safety match box, or light it with a match flame.



PULL WIRE FUSE LIGHTER

Cut the end of the fuse off squarely with a clean sharp knife, insert the fuse in the open end of the lighter until it lightly touches the end of the wire, then pull the wire. Ideal for use in the wind or rain.

For Sure-Fire Lighting

You *can* light safety fuse with a match. Slit the end of the fuse to the powder train, place the head of a match in the slit, and strike the head with a stone (or with the match box if a safety match). The flare of the head ignites the powder.

As a rule, operators have found it safer and more economical to use a fuse lighter. There are three excellent lighters available: the Hot Wire, shown here, which burns with an intensely hot ring of fire that ignites the powder; the Pull Wire, ideal for use in wind or rain, or when the flare and end spit should be confined; and the Fuse Match, which is struck like a match on any safety match box.

Lighters are cheap — and they pay their own way.

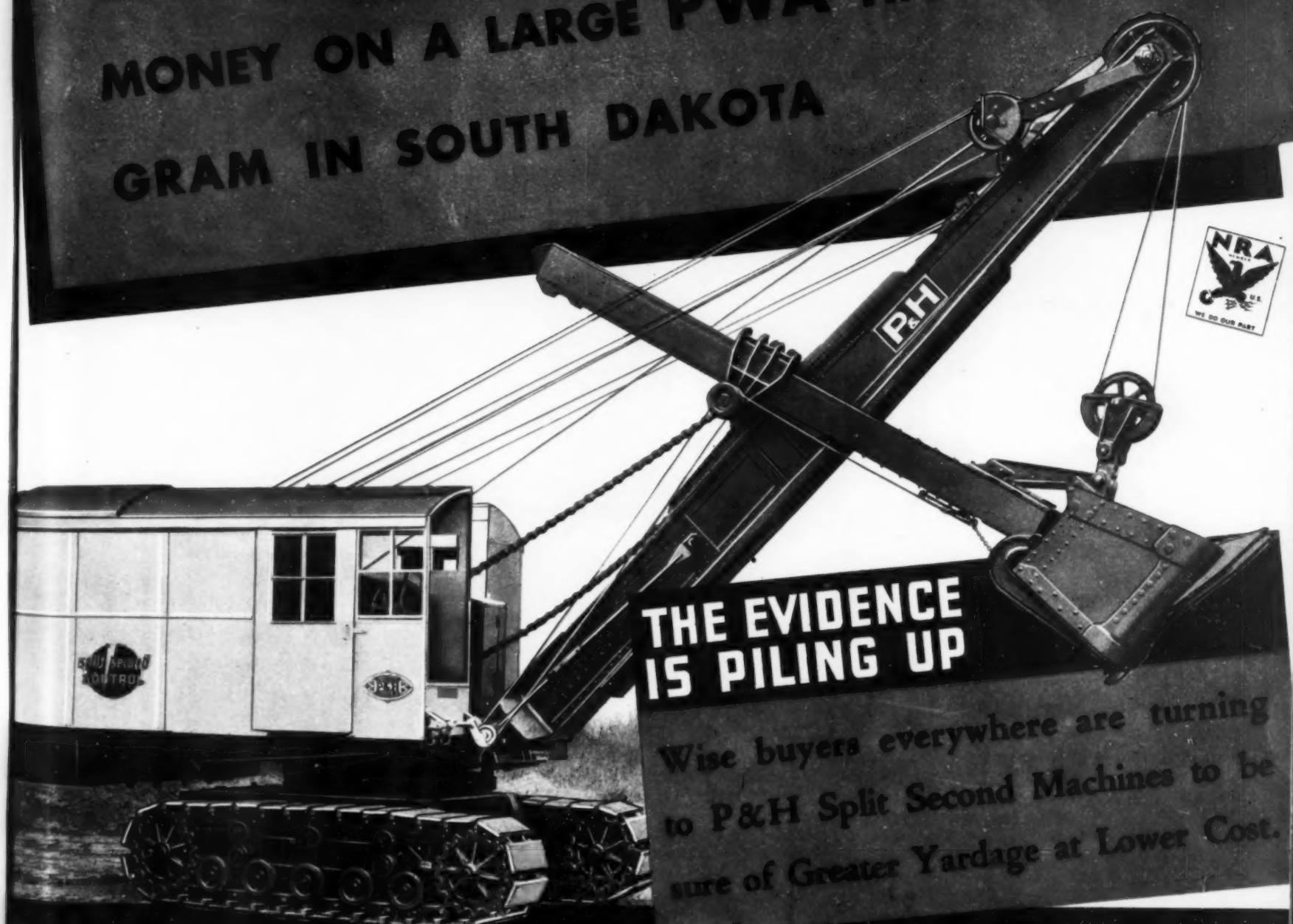
These pamphlets *give you the facts about these lighters and other Ensign-Bickford Blasting Accessories. Sent on request without charge.*

ENSIGN-BICKFORD SAFETY FUSE

ENSIGN-BICKFORD FUSE LIGHTERS

The PIONEER Construction & Engineering Corporation

HAS JUST BOUGHT A P&H MODEL 700B GAS POWERED SHOVEL WITH SPLIT SECOND CONTROL. IT IS MOVING MORE DIRT FOR LESS MONEY ON A LARGE PWA HIGHWAY PROGRAM IN SOUTH DAKOTA



THE EVIDENCE IS PILING UP

Wise buyers everywhere are turning to P&H Split Second Machines to be sure of Greater Yardage at Lower Cost.

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The LINK-BELT Type K-55

SHOVEL—CRANE—DRAGLINE

The largest of the six sizes in the Link-Belt line.

As a shovel, it will take a 2¼ cu. yd. struck-measure, all-manganese steel, heavy-duty dipper, or a correspondingly larger dipper for lighter service. As a dragline, it will handle a 2½ cu. yd. general-purpose bucket, or correspondingly larger bucket for lighter service on average boom lengths. It may also be equipped for long-boom work. It is not necessary to work with "high" boom or at "limited" radius to handle these loads readily and safely. As a trench hoe, the character of work and digging depth determine the size of bucket used. For normal digging depth, in average soils, a 2½ cu. yd. general-purpose bucket is standard.

Link-Belt's bucket capacity ratings are on the "struck-measure" basis. The actual "heap" measure capacity will average approximately 25% greater, depending on the material handled.

The K-55, like all other Link-Belt machines, can be shipped loaded on a flat car without dismantling. It is arranged for gasoline engine, Diesel engine, or electric motor drive.

As a crane, the K-55 has unusually large rated lifting capacities, all of which have a very liberal margin against tipping, i.e., 33-1/3% or more. Let us tell you what it will do on your work. There is no obligation whatever.

LINK-BELT COMPANY

300 West Pershing Road, Chicago Offices and Distributors In All Principal Cities

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Construction Methods

ROBERT K. TOMLIN, Editor

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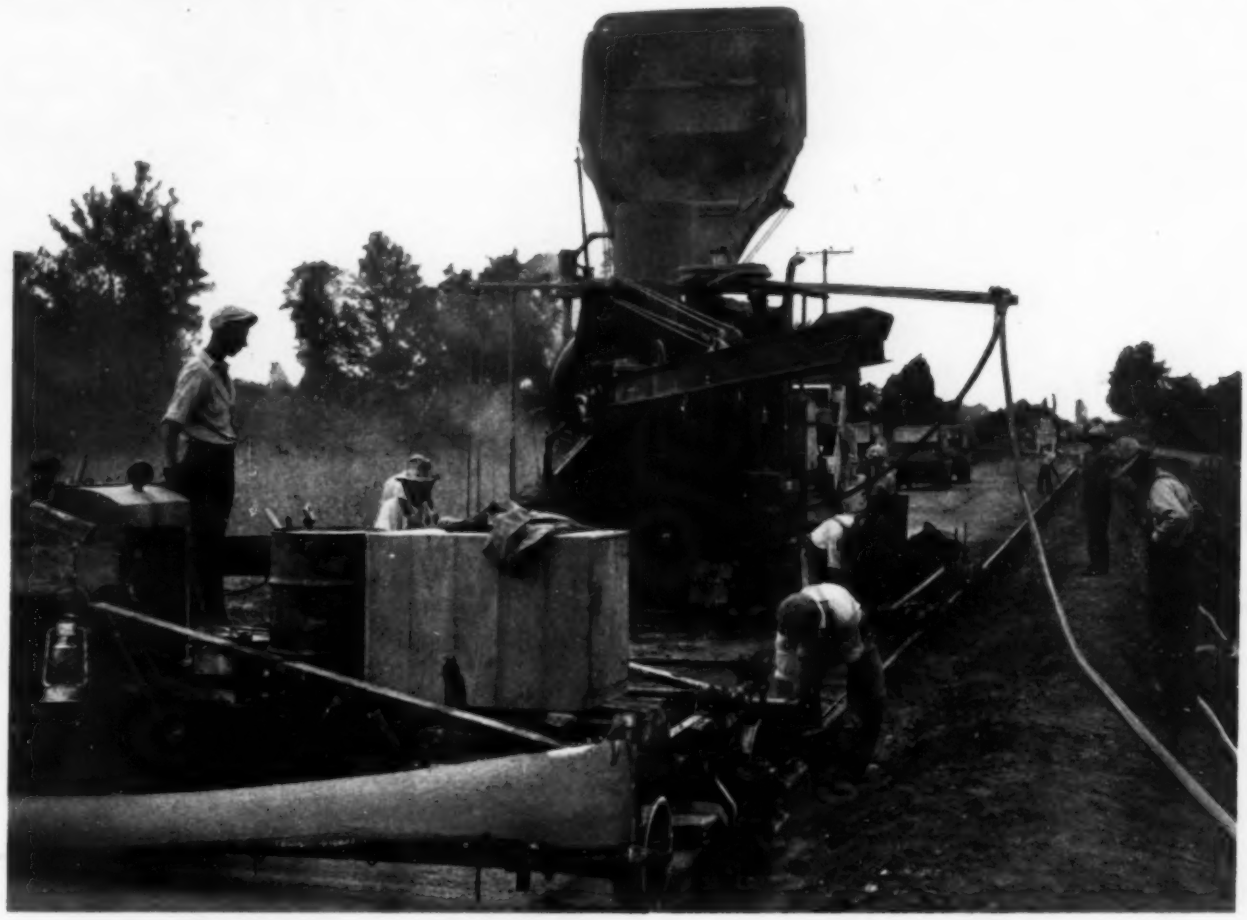


Unemployment Relief

for Local Labor Provided by Indiana Highway Commission

AS A DEMONSTRATION of how highway construction can provide employment for local labor, the Indiana state highway commission calls attention to an 11-mi. concrete paving project on State Road 3, south of Rushville, where more than 400 men from Rush County's unemployment relief list were given 30 hr. work per week. With the exception of the foremen and a few skilled operators, the entire crews for two 6-hr. shifts per day were furnished by the Unemployment Relief Commission of Rush County. These crews averaged 1,200 ft. of 20-ft. pavement per day.

Besides providing employment for more than 400 Rush County residents, the project also stimulated business and sales for local materials dealers and farmers. Nearly 300 tons of straw has been purchased to cover the slab during the curing period.

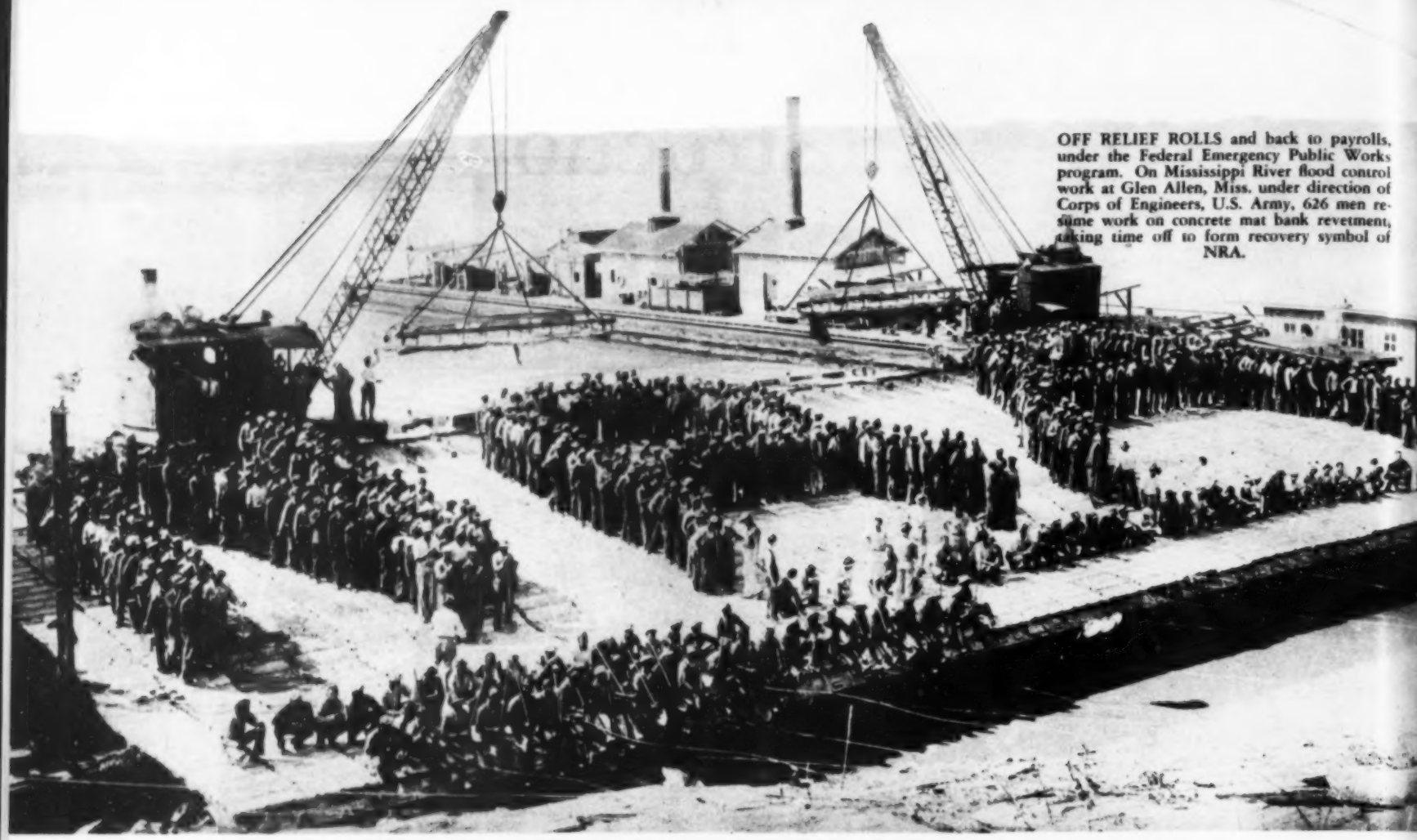
Several small bridges were included in the project. The new pavement, which is designed with 8-ft. shoulders on a 60-ft. right-of-way, shortens the distance between Rushville and Greensburg several miles, effecting a saving of time and operating costs for vehicles.

The project, one of many in progress in the state on which the working forces are drawn from local unemployed, was undertaken by the state highway commission with the aid of the Federal Government. The men worked under the same restrictions on employment and use of mechanical equipment as now are prescribed for federal aid on National Recovery highway projects. These restrictions on use of mechanical equipment were designed to provide more work for laborers and for teams.

Increased hourly rates for both skilled and unskilled labor, however, took effect in Indiana on all National Recovery highway projects with the first letting of contracts in this classification on Sept. 19. The new wage scale increased the minimum rates from 45c. to 55c. an hour for skilled workers and from 35c. to 47c. an hour for unskilled labor.

About $10,000,000 has been allotted to Indiana from the National Recovery highway fund of $400,000,000. An indication of the employment to be provided in the state by the expenditure of this sum may be gained from the Rushville project, built under the old Emergency Federal Aid program.

James D. Adams is chairman of the Indiana state highway commission, and Merton R. Keefe is chief engineer. On the Rush County project, B. R. Smith was engineer in charge for the highway commission.



OFF RELIEF ROLLS and back to payrolls, under the Federal Emergency Public Works program. On Mississippi River flood control work at Glen Allen, Miss. under direction of Corps of Engineers, U.S. Army, 626 men resume work on concrete mat bank revetment, taking time off to form recovery symbol of NRA.

This Month's

"NEWS REEL"

Back to Job Payrolls on Public Works Projects

PUBLIC WORKS PROJECT under construction at Naval Torpedo Station, Keyport, Wash. Jobs on repair of pier No. 1 are provided by funds allotted by Public Works Administration to Navy Bureau of Yards and Docks.

FEATHERWEIGHT BEAM OF ALUMINUM ALLOY *(below)* is readily handled by one man during replacement of steel floor system of 51-year-old Smithfield St. bridge, Pittsburgh, by high strength aluminum alloy members. New lightweight design by Aluminum Co. of America reduces dead weight of bridge by 700 tons, extending useful life of structure 25 years.

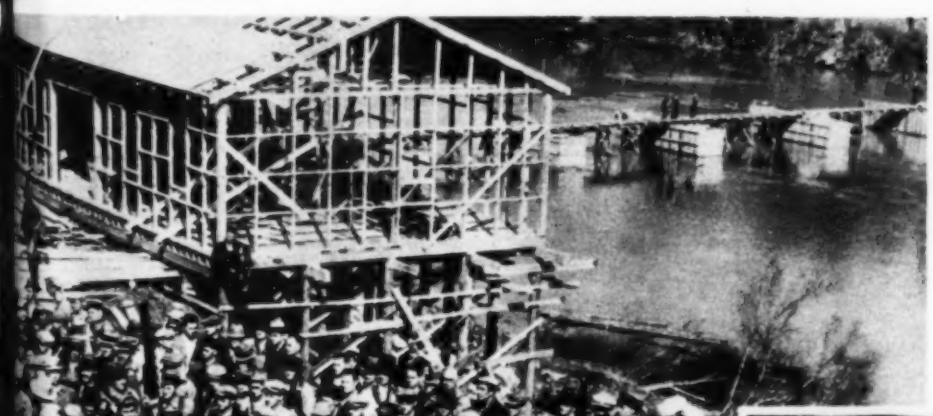
RECRUITED FROM RELIEF LISTS. Onondaga County, New York, gives employment to 6,000 men on grading operations for 285-mi. road building program.

Wide World Photo

CONSTRUCTION PROJECTS for New York City are discussed in conference at Washington between Mayor-elect Fiorello H. La Guardia and Public Works Administrator Harold L. Ickes.

Wide World Photo

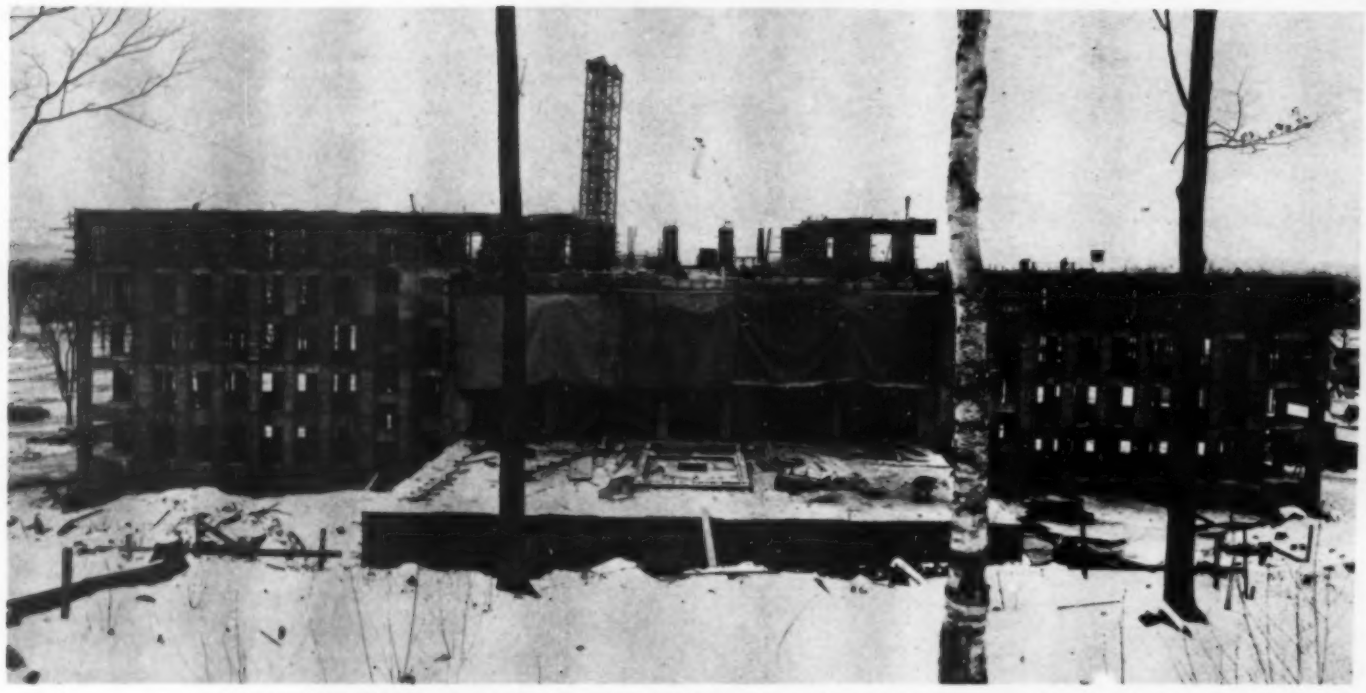
FOE OF UNEMPLOYMENT. As administrator of the newly organized Civil Works Administration program, Harry L. Hopkins is putting $400,000,000 to work on emergency relief projects throughout the country.



PAY DAY AT NORRIS DAM *(left)*. Two thousand workers on Tennessee Valley Authority project assemble to cash in on week's work.

CELLULAR COFFERDAM *(below)* of steel sheetpiles 54 and 48 ft. long aids construction of first 443-ft. section of concrete gravity dam, nearly 1,400 ft. long, at new Allegheny River Lock and Dam 2, for which Vang Construction Co. is contractor. Two pneumatic caissons were sunk to form foundation for abutment wall in foreground.

Acme Photo



CANVAS COVERING hung along walls retains heat from salamanders and keeps concrete from freezing.

Building Construction Maintained in

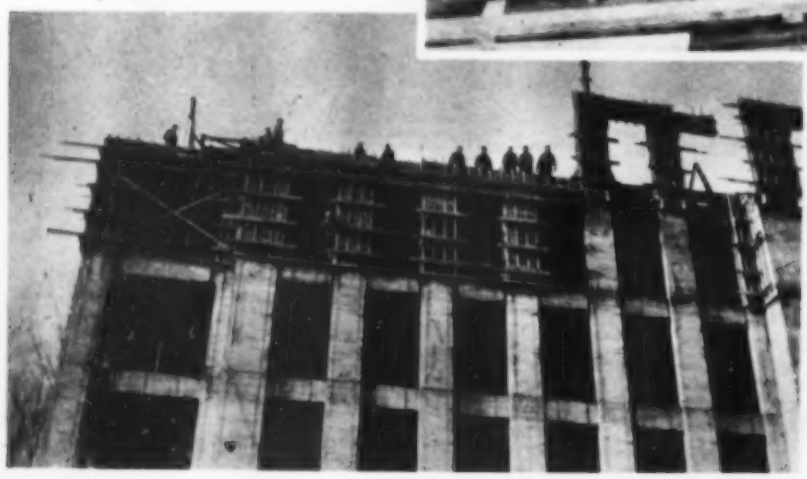
SUB-ZERO WEATHER

By FRANCIS Y. ARMSTRONG
Construction Engineer
Charles Smith & Sons Construction Co.

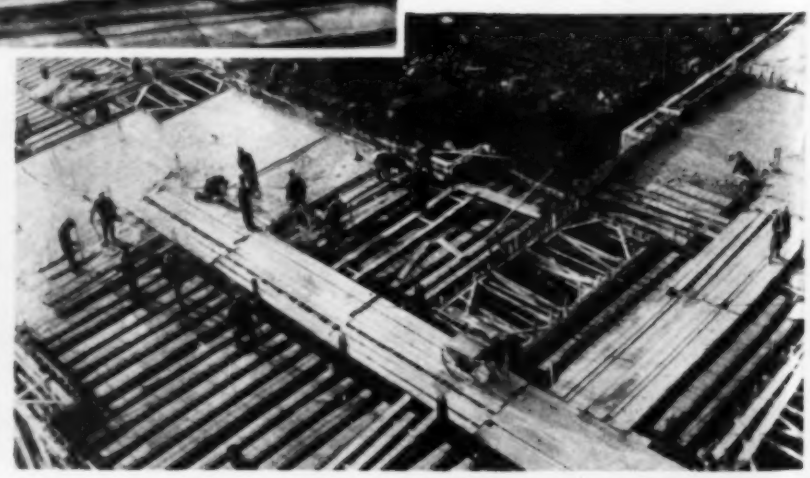
PLACING CONCRETE on metal pan floor construction at a temperature of 2 deg. below zero was one of the accomplishments in the construction of the new 9-story Veterans Hospital recently completed at Augusta, Me., by Charles Smith & Sons Construction Co., general contractors, of Derby, Conn.

The building was designed by Coombs & Harriman, architects, of Lewiston, Maine, and consists of the main building 303 ft. long and 45 ft. wide, with a rear wing approximately 160x60 ft. The exterior has a granite base course and limestone facing to the first story sills. Brick facing was used above the first story to the coping. The interior partition walls are of hollow tile with painted plaster finish. Finished floors are generally linoleum, with terrazzo base and border. Bath and toilet rooms have floors of tile. The

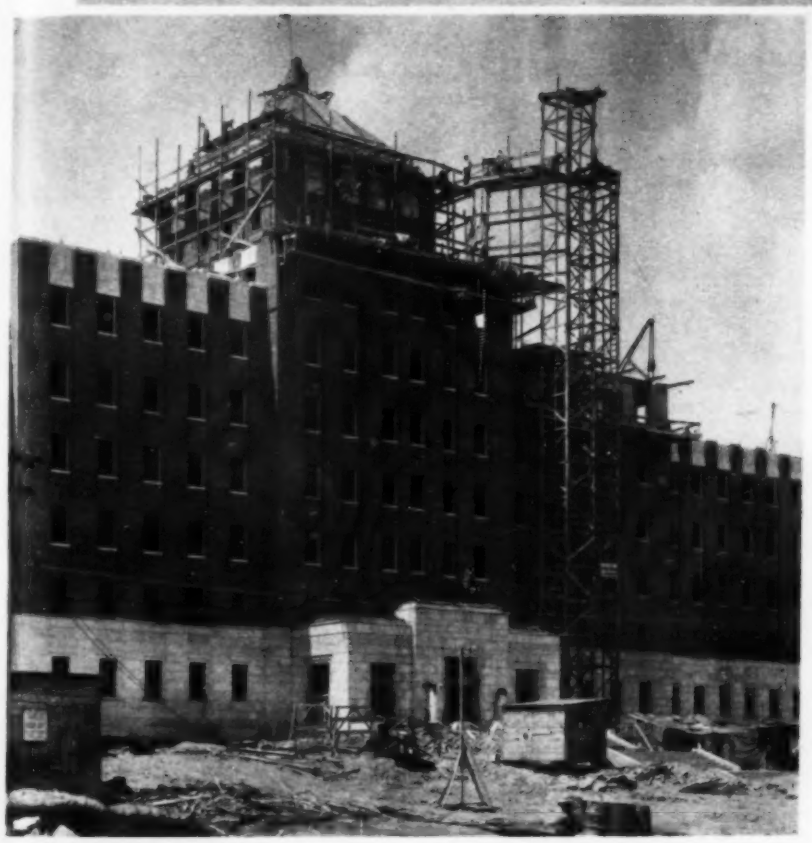
HEATED CONCRETE *(left)* is poured from buggies into metal pan floor forms (below).



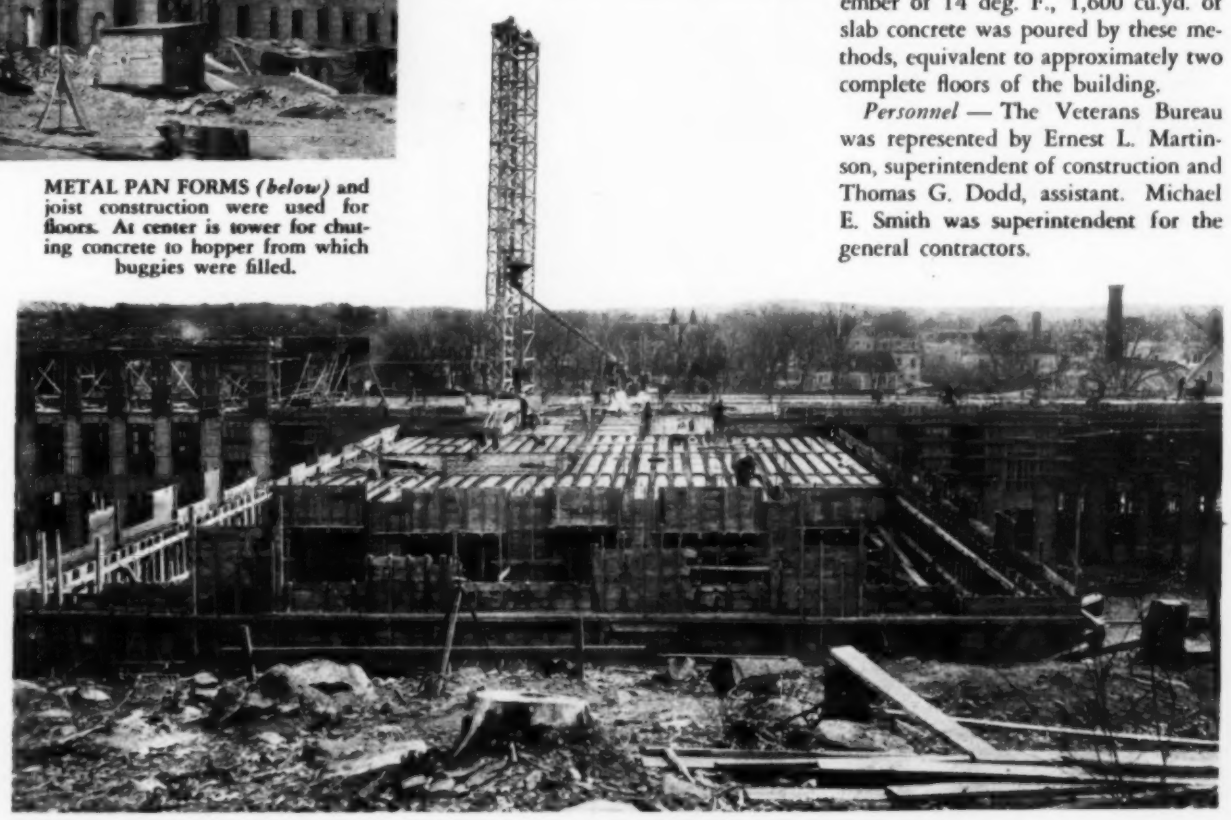
PANEL FORMS *(below)* for exterior columns and wall beams of building are raised, as units, into position for next pour.



FRAMEWORK COMPLETED. In snow-covered foreground, at right, are mixer shed, boiler house and steam-heated stockpiles of aggregate.



EXTERIOR FINISH OF 9-story structure is of brick above first floor, with limestone facing below.



METAL PAN FORMS *(below)* and joist construction were used for floors. At center is tower for chuting concrete to hopper from which buggies were filled.

rooms in the operating section have terrazzo floors and tile wainscot walls. Three elevators accommodate passengers and facilitate moving patients. The building has provision for 275 beds and doctors' and nurses' offices on each floor.

Forms—The framework of the building consists of reinforced concrete columns and beams to the sixth floor, with steel construction to the tower. During contruction of the concrete framing removable panel forms were used for the exterior columns and wall beams. Small hand derricks hoisted forms to the upper floors where they were anchored and clamped into place preparatory to the next pour.

Metal pan forms and joist construction were used for heavily reinforced floor and roof slabs.

Winter Construction—Soon after the contract was awarded in May 1932, it became evident that unusual foundation conditions were not favorable to rapid construction. This finally led to an investigation by representatives of the Veterans Bureau which resulted in changing the location of the building to higher ground and more suitable foundations.

Actual construction on the new site began Aug. 5, 1932 with a crew of 150 men. After placing footings, the lower wall and floor bearing columns during the fall months, it became apparent that consideration should be given to placing concrete at sub-zero temperatures if the schedule of operations was to be kept intact.

A 100-hp. boiler was installed near the building and connected to a system of piping. This piping consisted of a $2\frac{1}{2}$-in. main to which was connected a series of 1-in. branches, with small holes drilled every 2 ft. to allow escape of steam. Over this network of piping, aggregates were placed and the escape of steam was sufficient to keep the aggregates warm even at extreme temperatures.

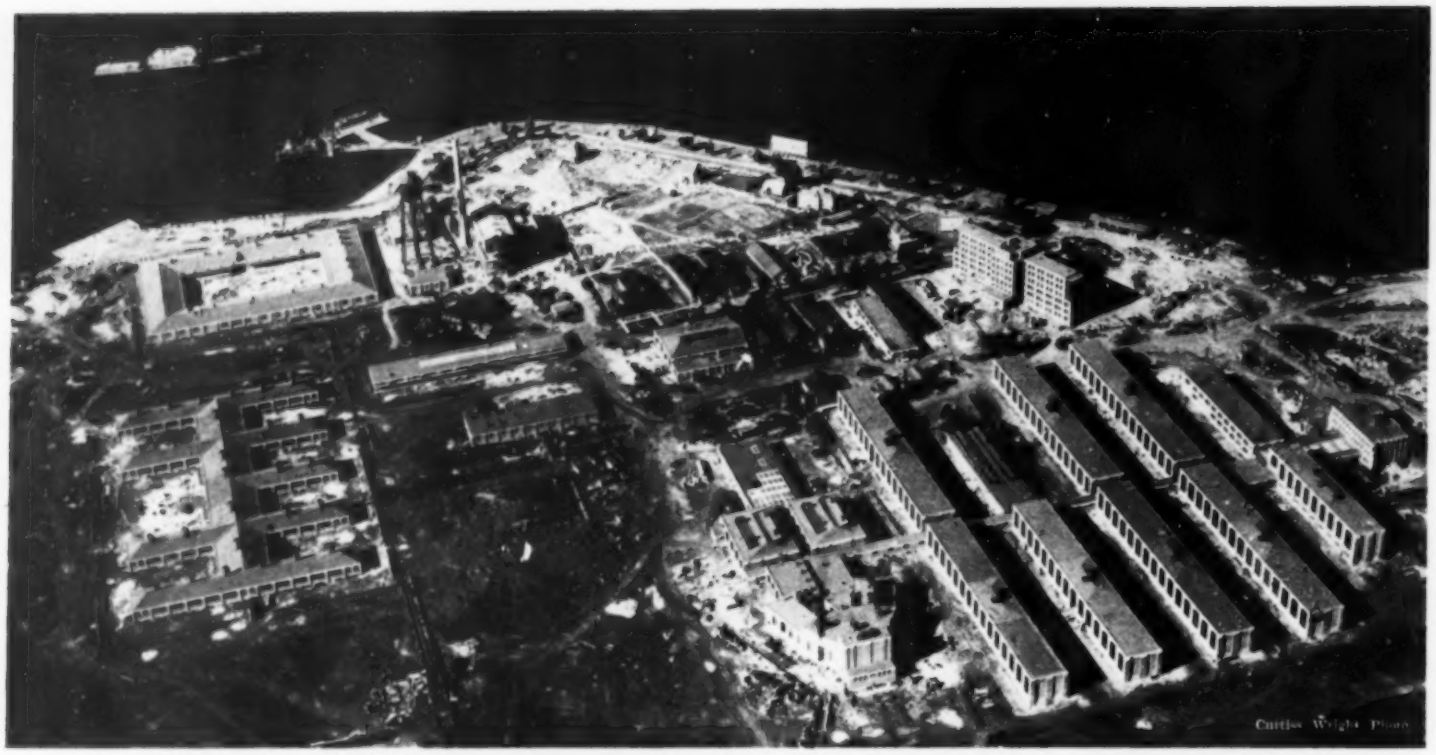
A Northwest crane equipped with a clamshell bucket was used to feed material from the stock piles to the batching plant. The cement shed was built as a housing on one end for the aggremeter and the mixer, with the mixer dumping directly into the bucket elevator. The bucket elevator dumping through a chute to a hopper conveniently placed on the floors made wheeling concrete by buggies to the forms a simple task.

During the early part of the winter it was indicated that, with temperatures as low as 18 deg. F., little possibility of freezing existed if heated aggregates and admixtures to eliminate moisture were used.

During December and January it became necessary to use other methods, inasmuch as the concrete work had to be completed. After many attempts it was proved that, by using heated aggregates and admixtures and coke-burning stoves or "salamanders" enclosed by canvas between floors, concrete could be poured without fear of freezing at nearly any temperature. This method was used with excellent success to temperatures as low as 2 deg. below zero, F.

With a temperature average for December of 14 deg. F., 1,600 cu.yd. of slab concrete was poured by these methods, equivalent to approximately two complete floors of the building.

Personnel — The Veterans Bureau was represented by Ernest L. Martinson, superintendent of construction and Thomas G. Dodd, assistant. Michael E. Smith was superintendent for the general contractors.



RIKERS ISLAND PRISON, occupying 65 acres, consists of 26 buildings, thirteen of which form one group (in right foreground) connected to single long corridor. New coal dock (at extreme left) is utilized for unloading materials involved in construction of huge plant.

Storage-Battery Lift Trucks and Portable Construction Units

Serve 65-Acre Building Project

REDUCTIONS in costs of handling materials and acceleration of building operations resulted from the application of storage-battery lift trucks and truck-mounted cranes to a multitude of service tasks at the new Riker's Island penitentiary, covering an area of 65 acres, which the P. J. Carlin Construction Co. has practically completed for the Department of Correction of the City of New York. Construction plant of unusual versatility and flexibility was required to carry on simultaneously a variety of operations at the 26 buildings under construction over this extensive area.

Two oustanding problems faced the general contractor: (1) mixing and placing 40,000 yd. of concrete; and (2) handling and laying 10,000,000 brick. In meeting the requirements of this situation, lift trucks and portable units of plant proved an adaptable and economical solution.

Prison Layout—Riker's island comprises 380 acres of land in the East River between the boroughs of the Bronx and Queens. A plot of about 65 acres on the northern side of the island, nearest the Bronx, is being utilized for the prison. Of the 26 buildings in the project, thirteen form one group connected to a main corridor, as indicated on the accompanying plan. The buildings are of steel-frame, concrete, and brick construction on pile foundations. All the buildings except the hospital and the power house are less than 50 ft. in height.

STORAGE-BATTERY CRANE equipped with gooseneck erects steel for three tiers of cells in narrow clearance under roof trusses.

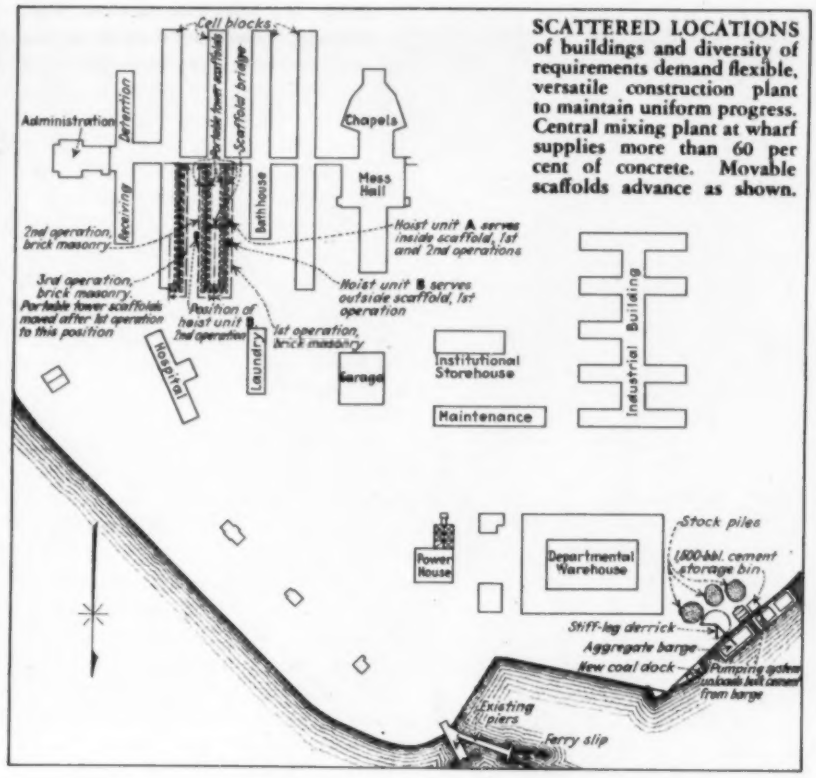
Included in the contract was a new coal dock 150 ft. long. The wharf at this dock was among the first structures completed, and all brick and concrete materials were unloaded from barges at this point. Subcontractors likewise unloaded their materials at the coal dock, and the general contractor located a central mixing plant close to the wharf.

Preliminary Operations—Starting Jan. 26, 1931, the contractor moved 1,000,000 yd. of earth in grading for the project. About the middle of April the Raymond Concrete Pile Co., subcontractor for foundation piling, was able to begin installing its tapered, reinforced, cast-in-place piles and composite piles. The latter type ran up to 105 ft. in length at the warehouse near the coal dock. By June 1, the general contractor had completed the central mixing plant at the wharf and immediately began to place foundation concrete. The National Bridge Co., subcontractor for the erection of structural steel, was able to begin its operations in July.

Steel erection proceeded continuously until the first week in October, when the skeleton frame of the last of the structures was completed.

Brick Masonry Construction—Common brick for the project, amounting to a total of 7,000,000, were unloaded from barges by belt conveyors which placed the brick in trucks. The trucks dumped the common brick at the locations where they were to be used. Face brick amounting to 2,900,000 units were received in steel containers holding 5,000 each. A crane at the wharf transferred the containers from barges to trucks; the face brick were unloaded from the containers by hand.

Most of the brick masonry of the project was laid up from hanging scaffolds, but about one-third of the total volume of brick, contained in the piers and walls of the cell blocks and other units connected to the main corridor, was built up by bricklayers on special portable scaffolds. The character of this brickwork, dispersed in a number

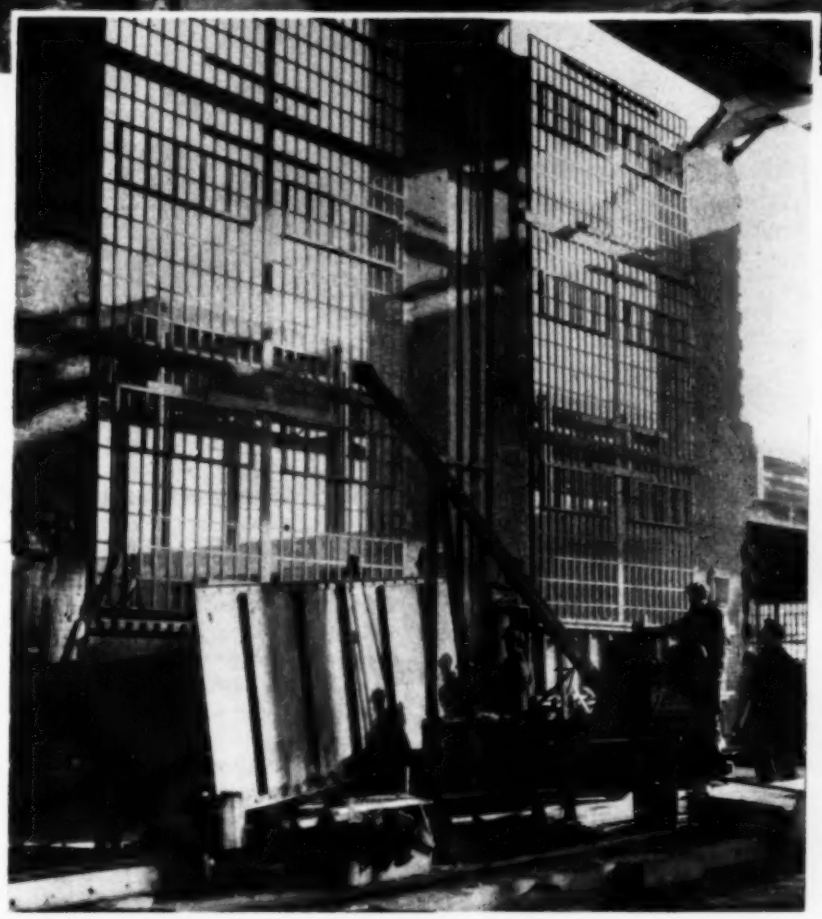


SCATTERED LOCATIONS of buildings and diversity of requirements demand flexible, versatile construction plant to maintain uniform progress. Central mixing plant at wharf supplies more than 60 per cent of concrete. Movable scaffolds advance as shown.

of units over an extensive area and rising to a comparatively low height, demanded a change from the conventional type of pole or hanging scaffold if operations were to be conducted economically. After consideration of the usual types of scaffolding, J. K. Bell, superintendent for the P. J. Carlin Construction Co., evolved a flexible and economical system of portable scaffolding which proved to be a valuable asset to the contractor.

Plan of Cell Block—Each cell block is about 322x48 ft. in plan and has a total of 32 large windows, 16 on each side, with a solid brick wall at the outer end of the building. Sixteen brick piers along each side wall of the cell block, spaced about 20 ft., c. to c., separate the windows and inclose the steel columns and ventilating ducts. Each of these piers contains 8,800 brick. Both the piers and the end wall of the cell block are 20 in. thick and 28 ft. high. The dimensions of the brick-

CRANE ATTACHMENT *(right)*, mounted on storage-battery lift truck from which operating power is derived, places steel-plate form for concrete spandrel under window sash.



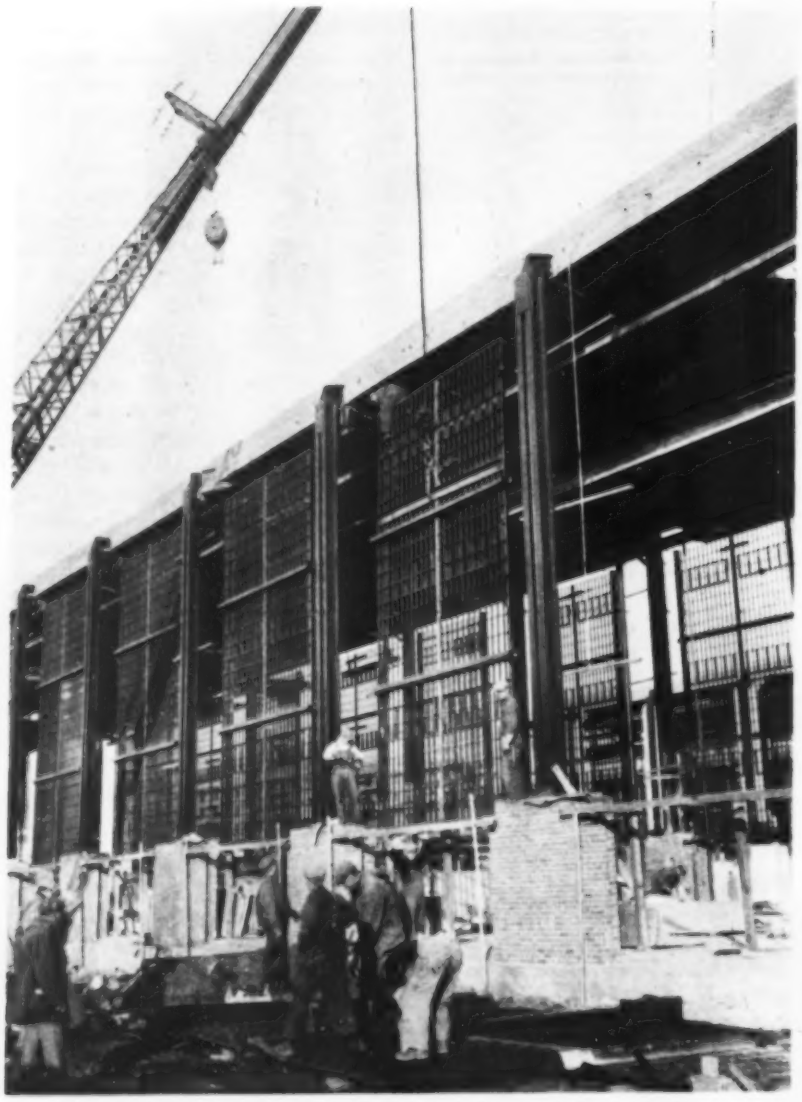
CELL BLOCKS are great, rectangular, steel-frame structures with columns incased in heavy brick piers.

work required a combination of exterior and interior scaffolding, and the dispersed character of the work made frequent changes of scaffolding necessary.

Portable Scaffolding—To meet these conditions the contractor employed a system of portable wood tower scaffolding made up of independent tower units. Towers of the exterior scaffolding, about 25 ft. high, were picked up and moved by storage-battery lift trucks. To prevent overturning, the towers were ballasted at the base with a heavy load of brick. Interior towers, of about the same height, were mounted on casters and were moved over the level floors by hand. No ballasting of these units was required. Two movable tower hoist units, placed outside the building, served both the inside and outside scaffolding.

Each tower was made up of four 4x4-in. posts and was of bolted construction throughout. The towers were cross-braced in the direction of the building walls. Cross-bracing was found to be unnecessary in a transverse direction and was omitted to permit laying of wheelbarrow runways through the towers. The contractor facilitated passage along these runways by unbolting and dropping one end of the ledger above the runway. Horizontal timbers bolted to the tower legs braced the line of towers in the direction of the building wall. The tower construction of the scaffolding made a firm and rigid structure.

Scaffolding Procedure—Slightly more than enough towers were available for the scaffolding of an entire cell block. The contractor made up a total of about 70 towers, 40 for exterior scaffolds and 30 for inside scaffolds. Brick masonry was laid up on one-half a cell block at a time. As soon as the bricklayers had finished the first half of a building, they shifted to the second half, scaffolding for which was already in place. While they worked on the second half, scaffolding from the completed half was moved to the first half of the next cell block. In this way, bricklaying went forward continuously, brief interruptions occurring only when the men



2½-TON STEEL SASH UNIT locked in frame of 4x4-in. angles is lifted to position by crane and supported by temporary struts and braces until piers and spandrel are constructed.

moved from one scaffold to the next. While the bricklayers were moving to a new scaffold, tractors pulled the portable tower hoist units into position to serve the new set-up.

Development of the portable tower scaffolding for the bricklayers on the cell blocks produced savings in both material and labor for the contractor. If pole scaffolds had been used, it is estimated that scaffolding for three complete cell blocks would have been required, with attendant labor expense for dismantling and erecting at each building. With the exterior tower scaffolding, however, a crew of four men and one storage-battery lift truck could move the towers for one-half a cell block from the old position to the new in 2 hr., exclusive of time for dismantling. Actual time required by the lift truck to pick up a tower, move it a distance of 315 ft., and set it accurately in a new position was 2 min. No skilled labor was needed to dismantle or erect the scaffolding and no delays ever were caused the bricklaying crew by failure to have scaffolding installed in advance.

Additional Uses of Scaffold Towers —After the bricklayers had completed the erection of the masonry piers and walls, the scaffold towers were applied to many other tasks by the general contractor and subcontractors. In erecting 2,000 tons of glazed terra cotta veneer on the inside of the cell blocks the general contractor used horse scaffolds to set the tile to a height of 10 ft. and then completed erection to the top of the wall by means of the scaffold towers. Ten towers were used in each building for this work, and four set-ups of the scaffolding were required to complete the tile erection in one cell block. Erection of glazed terra cotta was in progress in four buildings at the same time. To provide sufficient towers for this and other interior operations, the contractor added casters to many of the towers previously used outside.

Almost every subcontractor on the buildings connected with the main corridor rented the scaffold towers for his work. The towers served the sheet metal workers, the pipe coverers, the glaziers, and many others. In addition, they proved valuable in eliminating the need for much temporary scaffolding in doing odd jobs and patching subsequent to the actual construction of the buildings. Mr. Bell estimates that each of the 70 towers was used fifteen to twenty times and that many of the units were in continuous use for 12 months or more. On the brick masonry work alone, they eliminated the construction of 40,000 lin.ft. of pole scaffolding, exclusive of the scaffolds which it would have been necessary to erect later in washing down the walls.

Portable Hoist Units—To hoist brick and mortar to the bricklayers on the portable scaffolds, the contractor used two movable tower hoist units, each of which consisted of a 35-ft. wood tower equipped with a two-wheelbarrow hoist platform operated by a 35-hp. gasoline engine. Each unit was mounted on skids. Tractors drew the hoist units from one location to the next, the hoist engine providing sufficient weight at the base of the tower to prevent overturning. One hoist tower served the exterior scaffold, and the second hoist served the interior scaffold on both sides of the cell block by means of a temporary bridge through the center of the building.

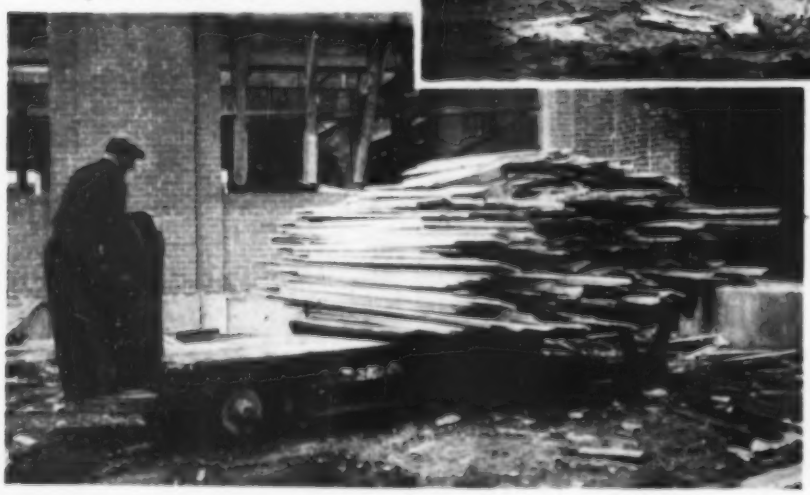
Concrete Requirements —Variation in the quantities and mixes of concrete required for the foundations and superstructures of the many scattered buildings of the project made it necessary to have a concrete plant of great flexibility, if concreting operations were to be carried forward simultaneously with any degree of economy. For the larger volumes of concrete, the contractor installed a central mixing plant near the wharf and equipped this plant to handle bulk cement directly from barges. To produce the smaller quantities of special mixes for fireproofing, floors, floor finishes, roofs, roof screed coats and for other structural requirements, the job was equipped with a number of portable ½-yd. mixers, three of which usually were in operation at one time.

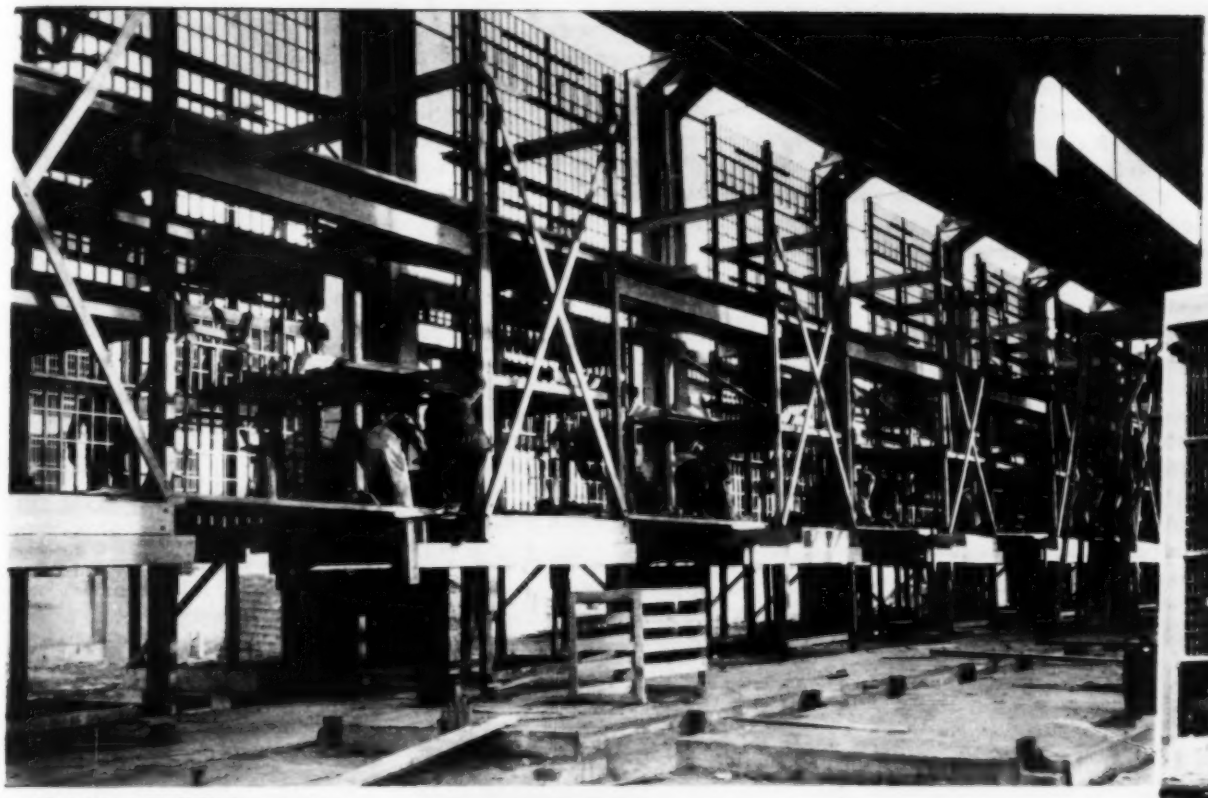
At the central mixing plant, a Fuller-Kinyon bulk cement unloader raised the cement from barges into a 1,500-bbl. Blaw-Knox steel bin. From this bin a screw conveyor and bucket elevator moved the cement to a compartment

SCAFFOLD LUMBER and mortar pans travel to next point of use on storage-battery lift truck.

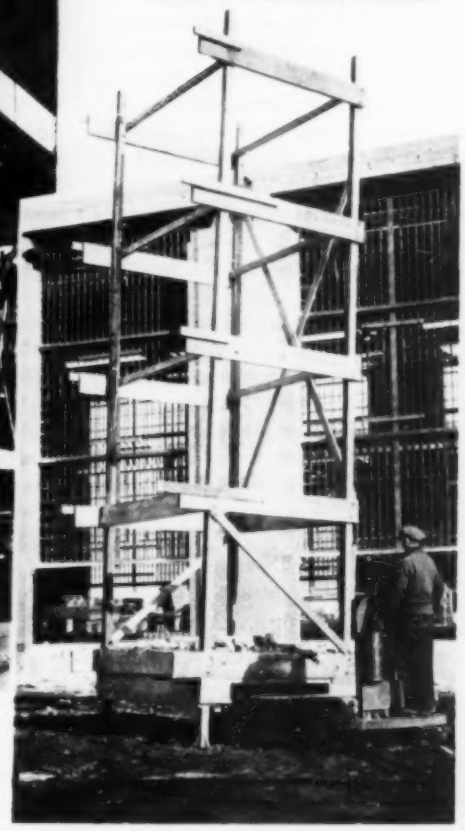
FACE BRICK *(below)* unloaded from steel containers are transported safely on skid platforms.

STORAGE-BATTERY LIFT TRUCK *(below)* picks up skid platform loaded with lumber.





MOVABLE TOWERS on steel casters form main elements of interior scaffolding for brick piers and end walls of cell blocks.



WOOD SCAFFOLD TOWER *(below)*, ballasted with brick to prevent tipping, rides on lift truck from one location to next in 2 min.

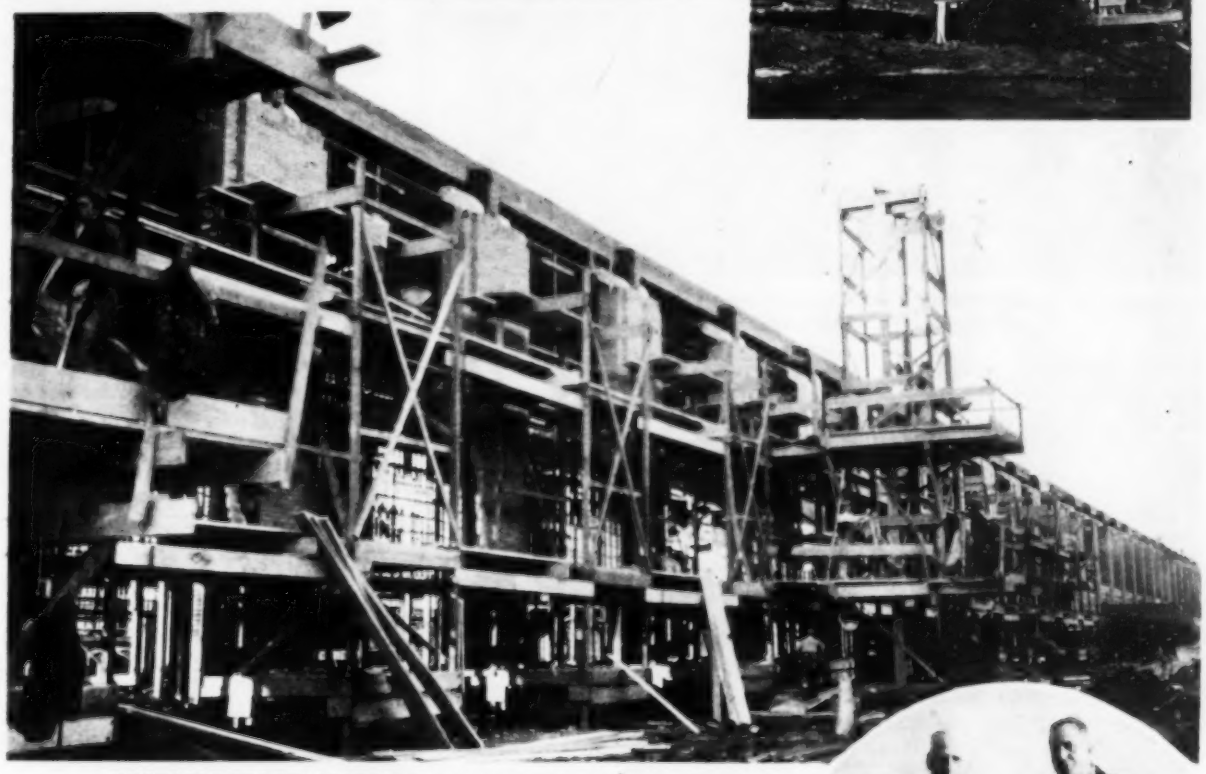
above the mixer. A steel stiffleg derrick with a 90-ft. boom, operated by a 90-hp. electric hoist and equipped with a 1-yd. Haiss clamshell bucket, handled concrete aggregates from barges at the wharf into hoppers above the mixer or into stock piles. A Butler batching plant measured the concrete ingredients by weight, and a Rex 1-yd. mixer, driven by electric motor, mixed the concrete. The central plant produced about 25,000 yd. of a total of 40,000 yd. of concrete used on the job.

Three Jaeger 5-yd. truck mixers, used principally as agitators, hauled the concrete from the central mixing plant to the point of placement. Because of the extra mixing given the batch by these trucks, it was possible to run concrete through the central plant much more rapidly than would ordinarily be permitted. Loads in the truck mixers usually were limited to 3 yd. to allow for rough ground and steep grades.

About 15,000 yd. of concrete was placed by the portable plants. The portable mixers produced practically all the cinder concrete for a 4-in. roof covering an area of 560,000 sq. ft. and for the attendant fireproofing of structural steel, which practically doubled the volume of cinder concrete. To place the concrete on the roofs, three portable tower hoist units were operated in conjunction with the mixers.

Wood forms were used for all ordinary arch work, and plywood forms for finished surfaces of ceilings, fireproofing, and copings. The latter forms usually were constructed by attaching the plywood to the studding or ribs of the wood frame, but the coping forms were made up in panels.

Scaffolds used in stripping the roof forms were suspended by Richmond "Tyscrus," installed when the forms were built and cast in the arch concrete. These scaffolds proved serviceable and safe for this work, not a single accident occurring during the stripping of the forms. The suspender wires were screwed out of the concrete after the forms had been stripped, and the holes were filled with sand-cement mortar.



PORTABLE WOOD SCAFFOLD TOWERS and movable tower-hoist units mounted on skids provide flexible plant for attacking construction of brick piers and end walls from outside.

Lift Trucks — Storage-battery lift trucks employed on the project were rented from the Terminal Engineering Co., Inc., of New York City. Each truck was equipped with four-wheel drive, having a separate motor on each wheel, and was capable of traveling at a speed of 10 mi. per hour light and 7 mi. per hour loaded. The lifting device consisted of four steel screw jacks driven by roller chains from the identical motors which propelled the trucks. A four-wheel steering mechanism made it possible to turn in an extremely short radius. By putting the storage batteries and motors under the flat body of the truck, the manufacturer obtained a greater area for load carrying but reduced the clearance to 6¾ in. Because of the short clearance, the contractor feared that the trucks might mire in soft ground. The four-wheel drive feature took care of this hazard, however, by keeping the trucks moving at all times. All motions of the truck were

W. C. BRINTON *(left)*, president, Terminal Engineering Co., and J. K. BELL, superintendent, P. J. Carlin Construction Co.

under instantaneous control of the operator.

Two or three lift trucks were almost continuously in use on the project. In addition to moving the scaffold towers, the lift trucks performed a great many other services, particularly in handling materials. For this latter purpose, the job was equipped with 18 lift platforms. These platforms served in the movement of brick, lumber and other materials. Special cranes mounted on TEC storage-battery trucks also performed a number of material handling services.

Storage-Battery Cranes—The cranes were of two types: (1) an attachment picked up by and automatically locked to a lift truck, and (2) a more powerful unit built up on a chassis similar to that of a lift truck except that it had no screw-jack lifting device. The crane attachment could be picked up or dropped instantly by a lift truck. Power for its operation was supplied through a short cable from the storage battery of the truck plugged into the charging receptacle of the crane attachment. The unit was equipped with a telescopic boom which could be set for various heights up to about 20 ft. above floor level. With a short boom, reaching to a height of 12 ft. above the floor, the crane had a capacity of 3,500 lb. The crane attachment set the steel spandrel forms under the large windows of the cell blocks and performed other handling jobs of similar nature.

The heavier built-up crane, also equipped with an adjustable telescopic boom, had a capacity of 3 tons with shortened boom reaching to a height of about 14 ft. above the floor. The general contractor used a crane of this type to handle artificial stone and several other materials, but the crane performed its outstanding service in setting 7,000 tons of cell steel three tiers (25 ft.) high inside the cell blocks for the Albee-Godfrey-Whale Creek Co., of Brooklyn, subcontractor.

Specifications prohibited the use of the structural frame of the buildings for any erection purpose, and the design provided little clearance between the roof trusses and the tops of the third tier. After consideration of several methods, including a traveling gantry, the erector selected truck cranes to erect the steel and a crane attachment and lift truck to load the material and transport it into the building. These units functioned efficiently.

Setting Window Sash—Heavy sash at the cell block windows, each about 22 ft. high and 14 ft. wide, had to be set in advance of the sill and pier masonry to which the sash is anchored. The sash for each window was delivered to the job in six sections to be welded into a unit in the field. After experiencing great difficulty in erecting the sash by ordinary methods, the Campbell Metal Window Corp., subcontractor for this work, adopted a plan of welding the 2½-ton unit on the ground, locking it in a temporary frame of steel angles, and hoisting the entire assembly into place with a Moore speedcrane.

STEEL PANEL FORMS for concrete spandrels under windows of cell blocks are tied together with screw connectors.

Progress on Cell Blocks—Placing the arch concrete on the roof of a cell block usually required 3 days. Brick masonry construction for an entire cell block was completed in 5 working days. Because of the time lost in moving equipment, 2 days were needed to place the concrete in the window spandrels.

Administration — Design and construction of the new New York County penitentiary at Riker's Island are under the direction of the Department of Correction of the City of New York. Richard C. Patterson, Jr., was commissioner of correction until his resignation. Robert L. Tudor, first deputy commissioner, now is acting commissioner; Isaac Goldberg is second deputy commissioner; and Joseph Fulling Fishman is third deputy commissioner and chairman of the building committee.

Operations at Riker's Island penitentiary are under the general direction of the bureau of construction and repairs of the Department of Correction, Maurice T. Bolmer, construction engineer, in charge; and Cyrus P. Meli, department architect. Francis H Phipps, assistant engineer, represents the department at Riker's Island. For the P. J. Carlin Construction Co., of New York City, general contractor, J. K. Bell, superintendent, is in charge of all operations. Sloan & Robertson, of New York City, are the architects.

Helps to Successful Contracting

Fifteenth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes.

By HARRY O. LOCHER
Contractor, New York

XV—Moving to Yard or New Job

"WHAT SHALL we do with this?" is a query heard many times when a contract is completed. Shall certain equipment, miscellaneous well used timber and supplies, small tools and odds and ends of various sorts be stored near the completed work, sold where and as they are, or moved to the new job or to a storage yard? In some instances, whatever is decided upon proves the wrong thing to do. This is unavoidable; foresight 100 per cent correct is possessed by no man. All that can be done is to be governed by the circumstances of each situation and by your own and others' past experience. In many instances careful thought would have prevented some mistakes.

Among the peculiarities of some contractors is their undying love for junk —equipment that has seen its best day and miscellaneous small tools and supplies that have not enough usefulness left in them to justify the care and cost their moving or storage entails. Many hoists, mixers, pumps, drills etc., for which contractors disdainfully refused a reasonable price at a certain time, have later met the ignominious fate of going to some junk man with this comment: "Take the damn thing out of the yard. What you offer is highway robbery, but I'm sick of looking at it, sick of spending money moving it from this yard to another, and from this corner to that. Take it away."

"Eight times out of ten the contractor gains by disposing of what he can on the site at the completion of the work, and the remainder as soon afterwards as possible."

Again, it frequently happens that when some piece of equipment, which has been kept in a yard for months or years, is sent out on a job, it is discovered to be useless, or to require for putting it in condition an amount of money out of all reason, considering what you will have when the usually obsolete machine is supposedly renovated. There is no economy in jacking up old whistles and assembling new shovels under them.

When a contract is completed, unless there is immediate or definitely known early use for the equipment, small tools and supplies that were used, it is a safe statement that eight times out of ten the contractor gains by disposing of what he can on the site at completion of the work, and the remainder as soon afterwards as possible.

Of course, it is not always possible to do this entirely, or even partly, and a storage yard becomes necessary. But too much equipment remains in a yard too long. Too many opportunities are lost to get fair prices for it, for the love of some owners is slow to cool and the value of the equipment goes down rapidly.

"There is no economy in jacking up old whistles and assembling new shovels under them."

Choosing a Site—When it becomes known that a yard is inevitable, great care should be taken to select a site which can be retained as long as it may be wanted, and one the cost of which will not be excessive. Many contractors have spent a great deal of money by not being sure of the length of time a hastily arranged for yard could be used. A great deal of money also has been spent in starting several yards without much looking ahead, and then, through unlooked for circumstances or lack of long range planning, having to go to the expense of collecting everything from several yards into a tardily arranged for permanent one.

Storage yards usually are started with great interest and zest. Everything is done meticulously—this yard will be the ace of all yards. Space is located with precision; roomy aisles are provided; shovels are placed together, as are pumps, hoists, mixers, reels of cable etc. No deviation from prearranged plans is tolerated. This yard is to be managed on a high plane. It will be handled as no yard was ever handled

before. It will delight the eyes of all who see it. It will be a model and a guide for others who will have yards. Such is the beginning of most yards and, of course, it is commendable and quite the proper way to do. But, in most cases the initial method and orderliness does not last. Soon slackness begins, or the men who were interested in the yard at the beginning are sent elsewhere and the newcomers lack interest. Usually the management, by this time, having lost much of its initial interest, does not hold yard men rigidly to account, and the intended ace of yards becomes just another deuce-spot—a promiscuous assemblage of you all know what!

Yard Layout—In beginning a yard there are certain things which should be done and an effort made to keep them up if money is to be saved, maintenance kept up and the movement of things in and out facilitated. First: The ground should be prepared for use as a yard; it should be made as level as possible, low places where water might stand should be filled with gravel, crushed stone or cinders—some material which will drain. Drainage should be arranged for over the whole area. Unless the yard is constantly watched, it should be safely fenced. Timbers should be piled according to lengths as nearly as possible; strips should be placed between them at proper intervals, both to prevent rotting and to facilitate getting chains or slings into place when reloading. Steel beams and girders, rails, any reinforcing steel should be piled according to length and size as nearly as possible, with division strips between to facilitate the use of chains or slings. Unless a crane is constantly available, heavy equipment should be unloaded on blocking for ease in reloading.

Early one morning two men were sent with a truck for a rented 4-yd. dragline bucket, thinking it could be swung on the truck with a crane in a few minutes when they reached the yard. But no crane was available. They found the bucket lying partly on its side in a low, muddy corner of the yard, with not a splinter of timber under it. It had simply been barred from the truck and allowed to land as it would. It took into the night to procure more men, timbers and jacks and get the bucket loaded. Had this bucket been unloaded on blocking or cribbing of the proper height with two sets of skids having rollers or short pieces of pipe between them, the lack of a crane would have made little difference in the time or cost of reloading it. In this particular case the bucket was not urgently needed, but, if it had been, the careless way in which it was left would have meant a considerable loss of money.

In a great many small or medium sized yards, cranes are not always available. In such cases it is a great time-, money- and trouble-saver to unload equipment with the idea of ease and economy in reloading, rather than to dump it off any old way to get rid of it.

A yard should be arranged to make it easy for cranes and trucks to move about and reach any piece of equipment which might be wanted. This means ample aisles and the careful placing of things—big, heavy pieces out in front, smaller, lighter pieces behind. The taking care of equipment after it has reached the yard was discussed in a previous article. The principal thing to watch out for is a let-down in interest.

"Unless stored equipment and supplies are ably and carefully looked after they will depreciate faster when idle than when they are being used. It follows that a yard man should know equipment and machinery and what attention is needed to keep them in condition."

Some owners, themselves, are as likely to be remiss in this direction as their employees. When this is true, it is futile to expect any real, sustained interest in the yard. Here, as most everywhere else, the proper interest and attitude from the top is the best assurance that a storage yard will be managed in the most efficient manner.

Equipment List—Unless care is taken, small things by the score can be lost in a poorly managed yard. They are chucked away out of sight, or get lost when things are moved about, until finally the ownership of them is entirely lost sight of. This means that money is often spent for identical things which are lying hidden away or covered up. It goes without saying, that a comprehensive, accurate list of everything in the yard should be kept. If room is limited and space has to be economically used, it is doubly important that an accurate list be kept, and that it should be consulted before putting money into new things already owned, but buried away in some out-of-sight place—forgotten! By a comprehensive list, I mean complete descriptions of the items—not a double-drum electric hoist, only, but the make, horsepower, and speed of the motor, the voltage, phase and cycle of the current, all starter information, and other usually needed name plate information. The name of the manufacturer of the hoist and the shop number, the length and diameter of the drums, the height of the drum flanges, line speeds a minute and single line pulling capacity. Then when you may want to consider a piece of equipment for a certain situation, or the office or yard is called upon to answer the inquiries of a potential buyer, you will have the information you need and will not have to tell your prospective buyer, "I'll have to look that up for you"—and discover later that he has bought elsewhere while you are doing the looking.

Yard Men — There should be no doubt of the honesty of the man in charge of the yard, or, if only watchmen are used, their honesty should be established. Leaks may occur here—not large ones, maybe—but many small leaks can sink big ships. As all thoughtful construction men know, many small leaks on a close-price job can make the difference between loss and gain. When only watchmen are on duty in a yard, it is far more economical and satisfactory to have men who are able to do something, even though their pay is higher than men totally unfitted to give any service. Lively, handy men are needed—men who can jump on a crane and load a truck with I-beams or timber, or who can load a truck with small things in jig time and run it to where it's wanted. And when there's nothing of this sort to do there is always important, money-saving work to be done in keeping stored equipment, supplies, small tools, etc., in as good condition as possible. It's a safe statement that unless stored equipment and supplies are ably and carefully looked after, they will depreciate faster when idle than when they are being used. It follows that a yard man should know equipment and machinery, and what attention is necessary to keep it in condition. He should know, too, how to operate equipment in order to demonstrate it when prospective purchasers visit the yard. Also he should be a man who can talk intelligently about the equipment in his charge, who is able to answer all practical questions that may be asked. He should be able, too, to understand and keep correctly the card record, or list of what the yard and storeroom contain, noting all changes up to date. There are so many ways in which wide-awake, capable yard men can save their pay over and over again, that it is rather a wonder that more first-class men are not in charge of yards.

"There are so many ways in which wide-awake, capable yard men can save their pay over and over again, that it is rather a wonder that more first-class men are not in charge of yards."

How a yard is handled makes vastly more difference than many think—in real dollars. Many years of experience — by many men — prove that the thoughtless accumulation of equipment, materials, supplies and small tools in a yard nearly always results disappointingly, and that the proper care of things kept from necessity or good reason—such as assured early use—is a profitable expenditure of money. Of course, some gambling has to be done as to retaining things for future use—but it should be "thoughtful gambling".

Moving Heavy Machines—On a canal job, two of the sections joined at a point near where a railroad crossed the project. These sections were being done by different contractors with large dragline excavators. The location was in a remote region and getting in equipment capable of hauling heavy machinery from the railroad to points along the project and back to the railroad was very expensive. One of the contractors mentioned above so arranged his work that when he completed it, his big dragline was within a few hundred feet of the railroad. Five hours tracking and it was at the railroad. Here, it was laid up.

A few months later the machine was needed. A derrick was set up and it was dismantled, the parts being arranged in an orderly way around the derrick. When the dismantling was completed arrangements were made with the railroad company for the use of a work train and the main line — between trains. The eight car loads were swung directly from where they had been placed, when dismantling, on to the cars Much time and money were saved. It cost a considerable amount of money to bring from a distance heavy hauling equipment with which to transport the other dismantled machine to the railroad. And hand loading at the site of dismantling and again on to the cars was an additional cost.

Of course, some equipment is too far from the railroad for such a method to be used, and expensive hauling is unavoidable. But often time and money can be saved by setting up heavy equipment at the nearest rail point and then tracking it to the site. The route should be studied carefully and there should be no doubt whatever as to whether the thing can or cannot be done. Bridges and overhead obstructions are the main things to investigate carefully. On a canal job a 2-yd. steam shovel was being moved on a scow. There was a misunderstanding of some sort about the clearance under a certain bridge, and when the tug, scow and shovel reached this point the shovel was swept off the stern of the scow in less time than is required to tell what happened-but it took several months and a great deal of money to salvage the machine from the middle of the canal in 12 ft. of water.

Moving heavy equipment about, either on the job, from job to job or from job to yard, requires great care and close attention. It is expensive work —and no estimates are received for it. "Bulling" nearly always costs both time and money. The selection of good and suitable equipment and supplies for contract work is a vital part of the construction business. What to do with them, and when, after they have served their purpose and have been stored, is almost as important.

A contractor's yard is a dangerous place and should be vigilantly watched. Unless it is, it will, in many cases, become the graveyard of many hard earned dollars.

FEBRUARY ISSUE: The sixteenth article in Mr. Locher's series will discuss "Accident Prevention."

Step-by-Step

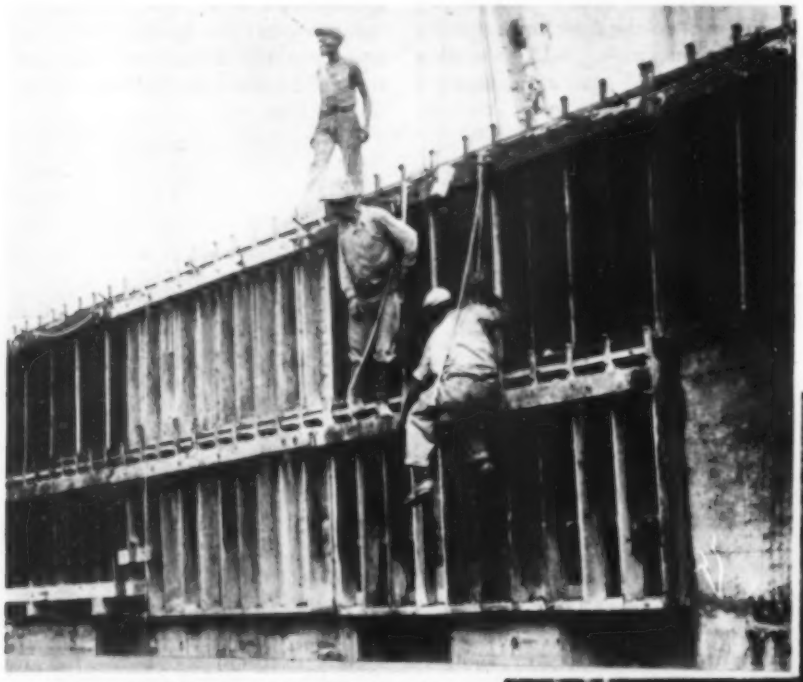
Handling Forms

By ADOLPH J. ACKERMAN

Formerly with Madden Dam Division.

The Panama Canal, C. Z.

1 SMALL SLING is tied to form panel, tierods are drawn back and panel is pried loose ready for raising to new position.



2 STRIPPING OF PANELS is done by crew of three men with aid of metal seat hangers hooked into upper form.

THE main construction unit serving the Madden dam for supplying water to the Panama Canal is a 25-ton cableway with traveling towers, as described in *Construction Methods* for March, 1933. Early consideration was given to handling both concrete and forms by this unit, the panels to be made as large as possible to keep the cableway time at a minimum. However, it was soon recognized that a superior arrangement would result if the cableway were limited chiefly to placing concrete and the panel handling done as an independent manual operation. Various schemes were studied and worked out on a model, the finally adopted system consisting of a double course of 5x15-ft. panels, raised by a portable jib-mast, powered by a separate portable air hoist, as shown in the illustrations. The air is taken from the normally available supply used for cleaning concrete surfaces, etc.

The specifications for the dam required that concrete be placed in 5-ft. lifts and that smooth faces be obtained by using either metal or metal-faced forms. No tierods or other metal devices may remain within 2 in. of the final surface. All forms must be painted with non-staining oil before concrete is placed against them.

The spacing of 56 ft. between contraction joints in the dam resulted in the use of four 14-ft. panels on the upstream and downstream faces of each block. The downstream inclined panels are 6 ft. 3 in. high along the face. Each panel consists of eleven 2x6-in. studs, and 2x6-in. sills, all metal-bound at the joints with strap iron, with 1x6-in. sheathing on the face and a 6x6-in. waler on the back. The lumber is No. 1 common Douglas fir, s 4 s. Between the studs and waler a row of form clips is set to transmit the lower horizontal reaction of the upper panel to the waler. The clips are made of ¾x2-in. steel

4 HOISTING CREW of three men *(below)* carries light jib-mast and sets it above panel. A hole in base slips over a U-anchor set in concrete.

3 GENERAL VIEW OF MADDEN DAM, showing cableway for delivering concrete and forms in place for blocks of main body of structure.

5 AS PANEL IS RAISED, two men hold it clear of projections on last lift of concrete.

Field Methods

on Madden Dam

bar, with a right angle bend bearing against the bottom of the waler and bolted to the studs with ⅝-in. carriage bolts. The face of the panel is covered with a sheet of 16-gage metal, mill-sheared to the proper size and tacked on with nails. This thickness of plate has proved highly satisfactory in holding its surface and avoiding local bulges and bumps.

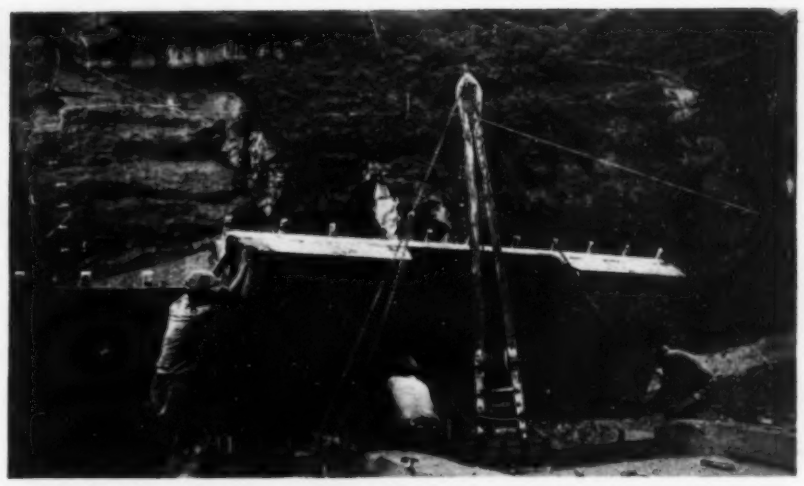
The tierod system consists of Williams waler rods which pass through the form at an angle of 45 deg. and extend beyond the face 3 to 4 in. where their hollow ends receive the threaded ends of ⅝-in. tierods; these in turn hook into U-anchors set in the concrete. One tierod is located at each end of a panel where it supports through a special washer the end of the adjacent panel. An intermediate rod was formerly used at the center of the panel, but this was later changed to two at the third points to reduce deflection and creeping under load. A thin coat of oil over the ends of the waler rods allows them to be withdrawn readily after the concrete has hardened, after which the hole is plugged.

The contraction joints in the dam are designed with keyways 5 ft. wide by 1 ft. deep on 10-ft. centers. This required half of the 15-ft. long panels, with one keyway box at the center, to alternate with panels having a keyway box at each end. Some concern was felt at first about stripping these boxes and it was originally planned to toe-nail them lightly to the panels so that the latter could be pulled loose and the boxes stripped independently. However, it was found feasible to strip the entire unit, and the boxes were bolted directly to the studs. Only two tierods per panel are used on the joint forms, and in place of metal-faced sheathing the panels and boxes are built up of 1x4-in. tongue-and-groove flooring.

The estimated weight of a panel is 1,200 lb. and a total of 400 was built, exclusive of special panels. The handling of the panels is described in the illustrations. In general, the system has proved satisfactory, but experience has indicated the desirability of surfacing the keyway panels with thin sheet metal of about 26 gage, which would still allow nails to penetrate for mounting the various grout pipe fittings, etc., would make stripping and cleaning easier, and would increase the life of the panel. A panel is good for at least 10 to 15 re-uses. Under this system concrete placing has been consistently maintained at 55,000 to 66,000 cu.yd. per month.

Personnel—The Madden dam was designed by the U.S. Bureau of Reclamation in coordination with the Panama Canal, and is being constructed under the supervision of the Canal Zone Administration, including Col. Julian L. Schley, Governor; Col. C. S. Ridley, engineer of maintenance; and E. S. Randolph, construction engineer. The total estimated cost of the project is $15,000,000. The Government furnishes all materials, and a contract for construction of the dam and appurtenant works is held by W. E. Callahan Construction Co. and Peterson, Shirley & Gunther, under a bid of $4,048,657. Paul Grafe is managing director for the contractors and R. M. Conner, general superintendent. The writer, as chief engineer, designed the forms and general handling features in cooperation with former superintendent C. P. Dunn, and various refinements have been added from experience by the field forces.

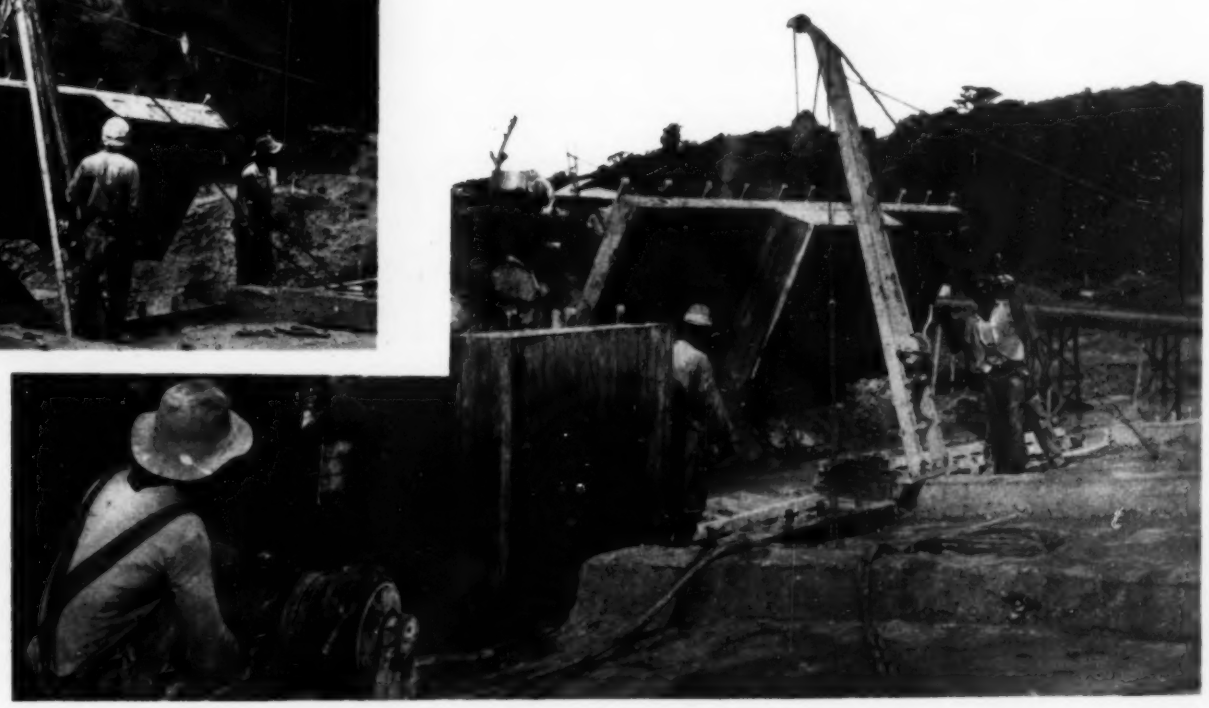
(Continued on next page)



8 MAST IS DRAWN BACK and air hoist lowers panel to position for next pour of concrete.

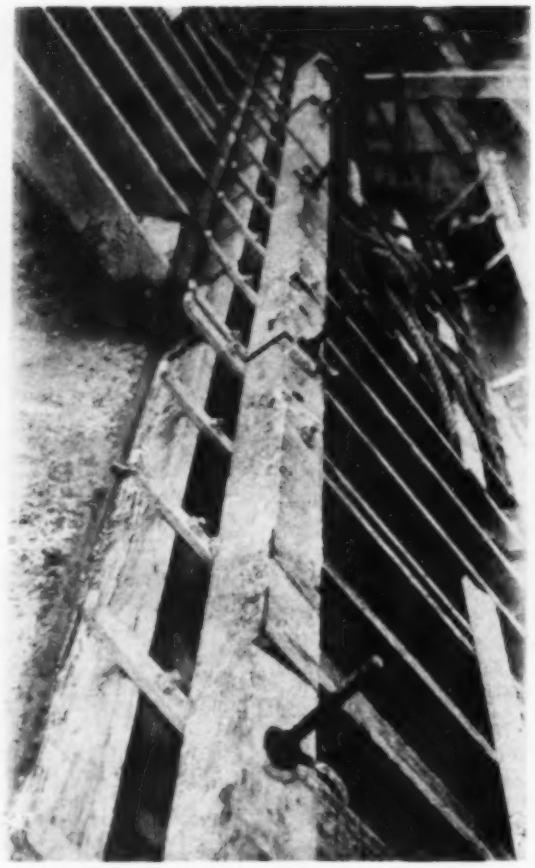
9 SETTING OF VERTICAL FORM completed. Pipe struts are removed and form is partly filled. Vertical pipes are part of contraction joint grouting system. Projections above forms are avoided to prevent striking by cableway bucket.

7 WHEN RAISED to maximum height, air hoist *(below)* is dogged off. From sheave near top of mast single cable is anchored directly to rear of mast and runs over small winch on mast. With this rigging, mast is drawn toward vertical, bringing panel into position.



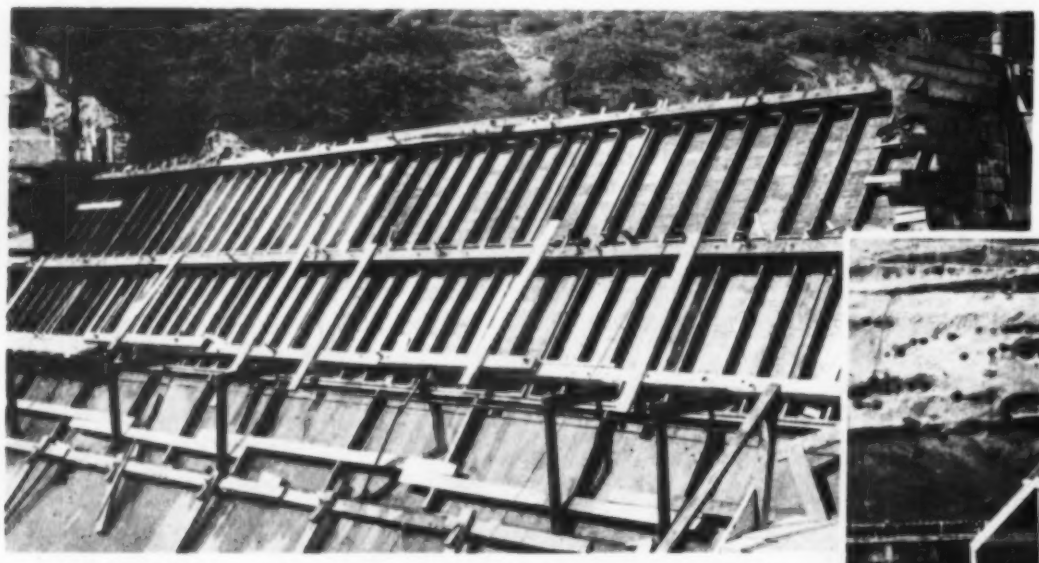
6 COMPOSITE VIEW of hoisting system. Panels are raised by small portable air hoist which is hooked to anchor in concrete and remains in place, only jib-mast being moved around edge of pour. At corners, snatch blocks guide ⅜-in. hoisting line to mast. Note how anchors for form tierods are utilized to guy mast, while chains allow easy adjustment of length. This view shows single keyway type of panel.

10 INCLINED FORMS are raised on downstream face of dam. Panels are skidded up and held clear of sharp projections.



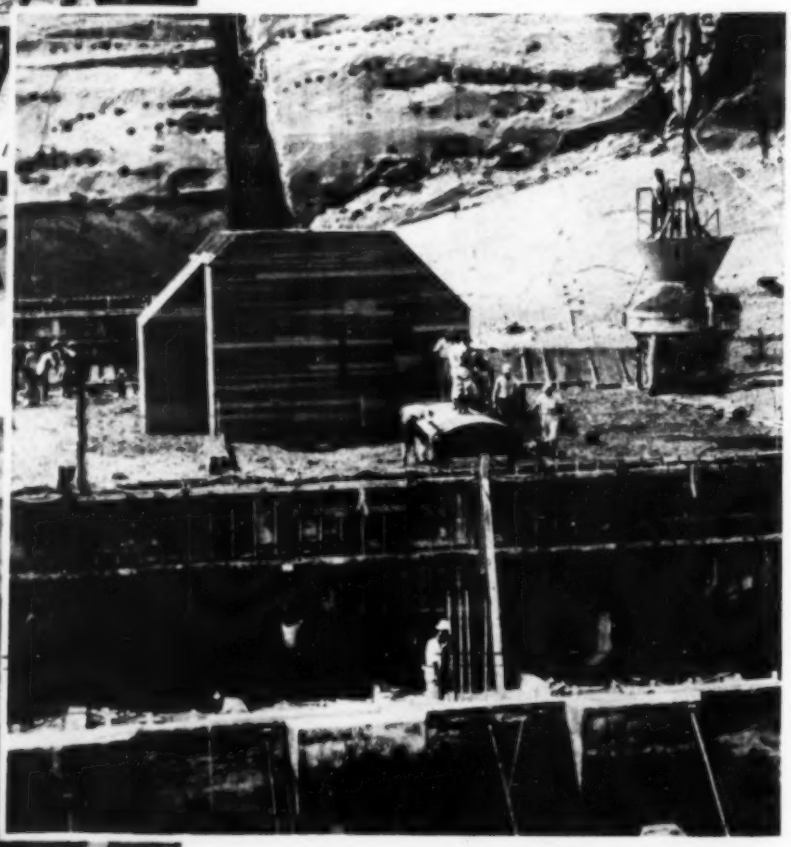
11 DETAIL of form clips and tierods for holding inclined form in place on face of dam.

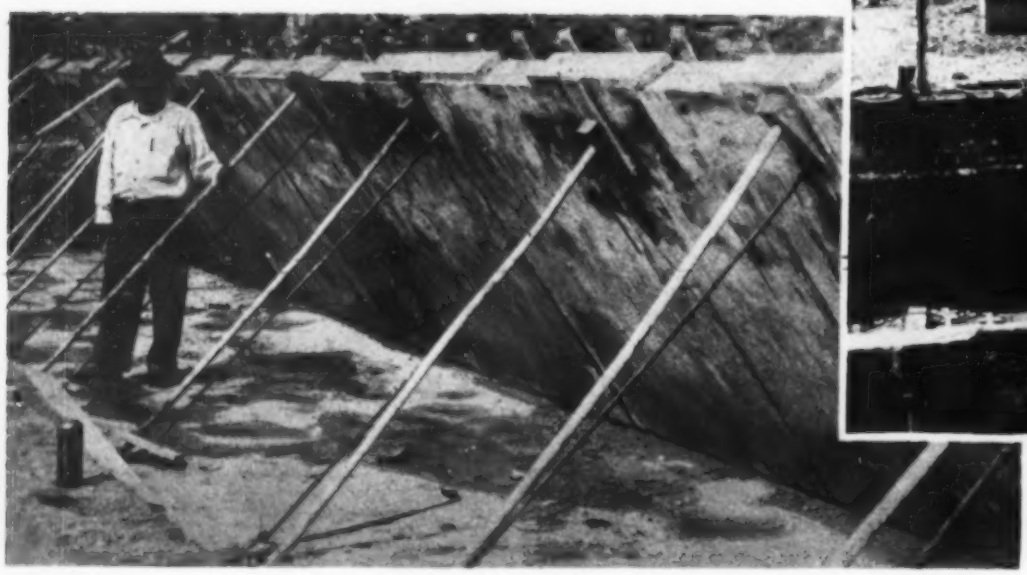
14 SPECIAL FORMS such as those for operating galleries of sluice tubes are built on ground and set by cableway in one piece.



12 EXTERIOR of downstream face forms. Brackets for temporary walkway along bottom of panel are not part of of regular panel system.

15 CONCRETING *(below)* around 20-ft. high gallery form through main body of dam is done by cableway bucket.





13 COMPLETED SETTING *(left)* of inclined metal face panel with 1½-in. removable type struts. Forms are oiled before concrete is poured.

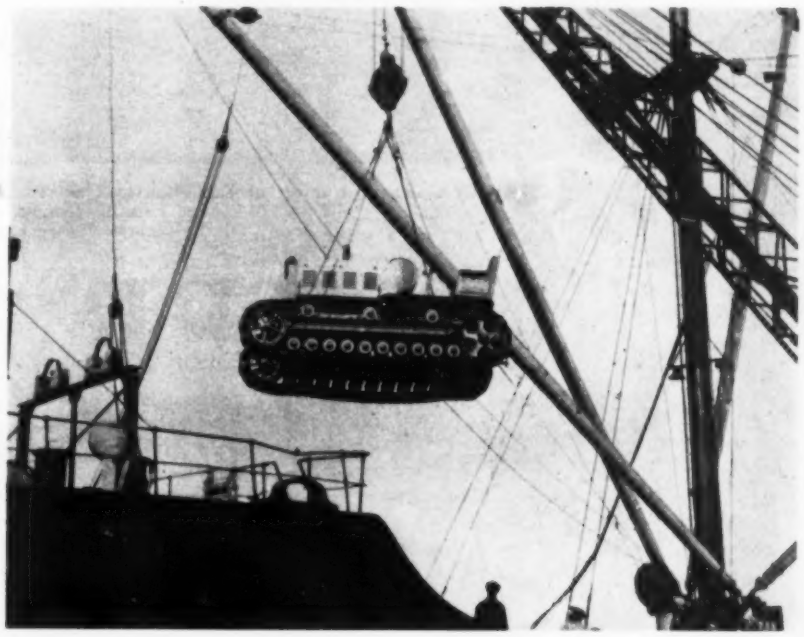
JOB ODDITIES

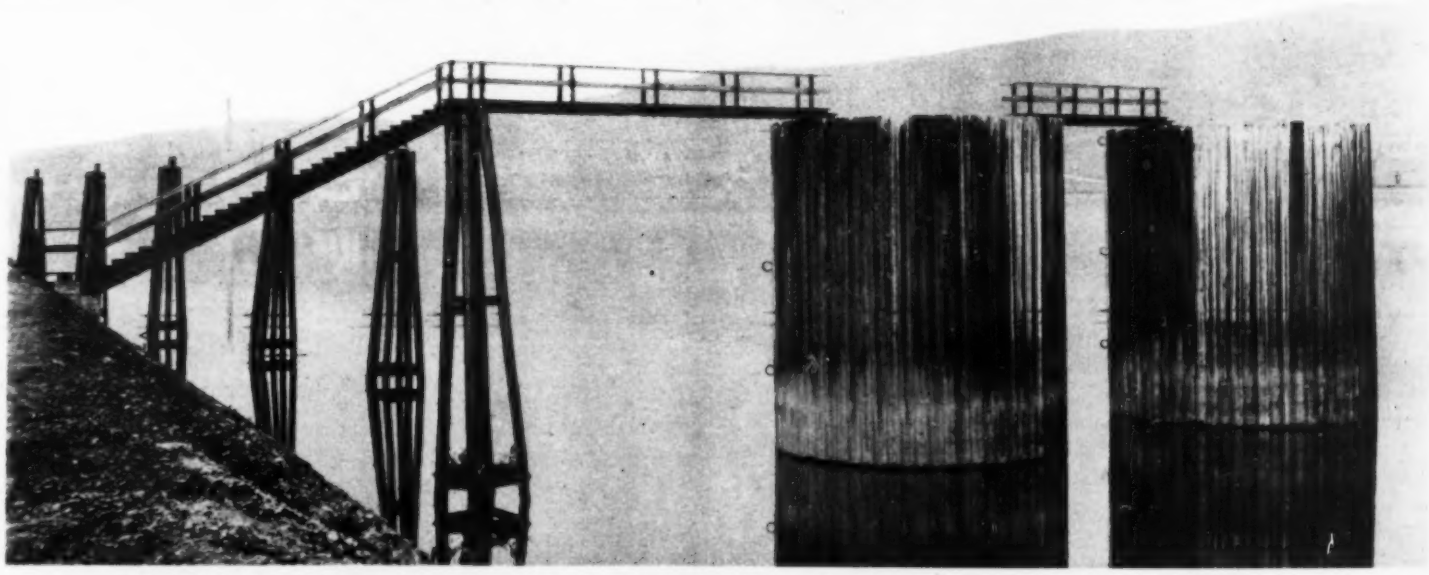
A Monthly Page of Unusual Features of Construction

STEEL CYLINDER, 15 ft. in diameter and 20 ft. long, is lowered to place for welding to form one of 28 dredging wells in the 74½ x127-ft. caisson for pier No. 6 of the San Francisco-Oakland bridge. Caisson is to be floated to place and sunk in water 105 ft. deep by Trans-Bay Construction Co. Clamshell buckets, operating through dredging wells, will remove soft material overlying rock bottom of bay.

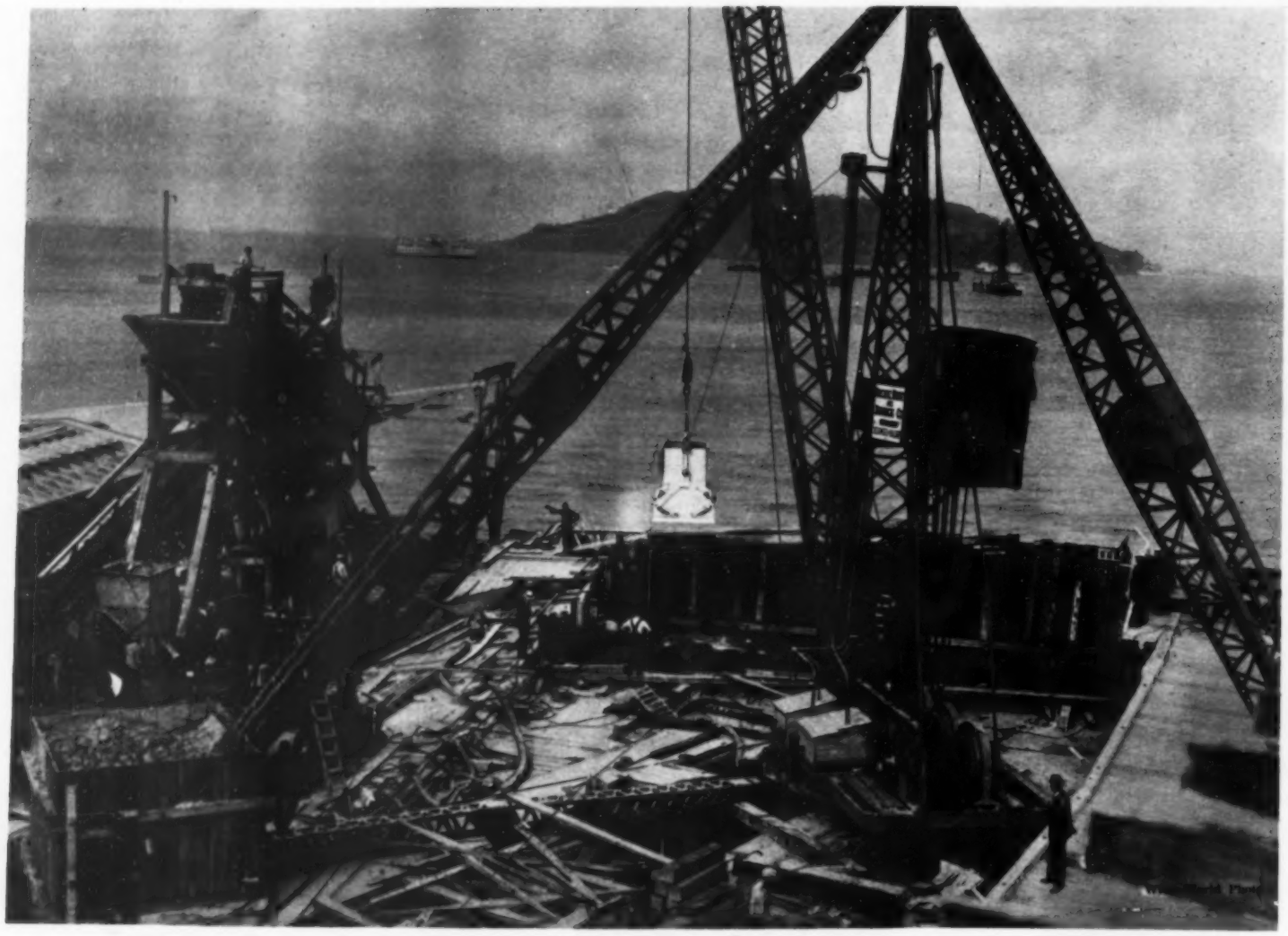
NEW DIVING BELL, in demonstration at Seattle, Wash., carries Capt. C. B. Mayo, Navy officer, to depth of 400 ft. in Puget Sound. Pear-shaped steel globe with thick glass port-holes in conning tower, designed by Gene Romano, mechanical engineer, is equipped with claw-like fingers on articulated arms for salvage work, electric flood lights and telephone lines to surface. Tanks carry supply of air and oxygen.

BOUND FOR SOUTH POLE *(below)* Admiral Richard E. Byrd loads Cletrac crawler tractor aboard his ship "Jacob Ruppert" at Norfolk, Va., for heavy hauling over ice and snow when second Antarctic expedition reaches Little America.





ICE BREAKERS. To protect barges at river and railroad terminal on Ohio River at Colona, Pa., Dravo Contracting Co. constructs for Pittsburgh & Lake Erie R. R. two 30-ft. diameter cylinders of Carnegie interlocking steel sheet piling in 80-ft. lengths. Cylinders are filled with dredged material and capped with concrete.



PIER CONCRETE for tower of San Francisco-Oakland Bay suspension bridge is poured within steel sheetpile cofferdam by 4-cu. yd. bottom-dump bucket.

MIXER BARGES

Supply Concrete for Piers of San Francisco Oakland Bay Bridge

A FLEET of barges each providing compartments for 40 batches of aggregate, a complete water system, concrete mixers and belt conveyors is the outstanding feature of the equipment designed by the Henry J. Kaiser Co., Oakland, Calif. to provide about 700,000 cu.yd. of concrete for the foundation work on the San Francisco-Oakland Bay Bridge. This concrete will be distributed to at least 25 individual pier sites extending over a distance of almost 4 mi. The main plant on the Oakland side will supply concrete for the four piers and the common anchorage of the west channel suspension spans being built by the Transbay Construction Co. and, also, the 20 piers for the cantilever and truss spans

CONCRETING IN THE DRY. Elevation of pier masonry within cofferdam has risen, in three weeks, to point above water level.

east of Yerba Buena Island, the contract of Bridge Builders Inc. A smaller plant on the island will supply concrete for the Clinton Construction Co. on its contract for the anchorage and tunnel. The batching plant and mixing-barge equipment have recently been put into service and although minor changes may be required the general plan of operation is substantially as follows:

Batching Plant — The 800-ton-per-hour main batching plant is located at the Oakland harbor end convenient to the railroad facilities of the Southern Pacific and Western Pacific. A specially constructed wharf provides three tracks for aggregate cars and one for cement. The batching plant is situated at the outer end and the space along the sides

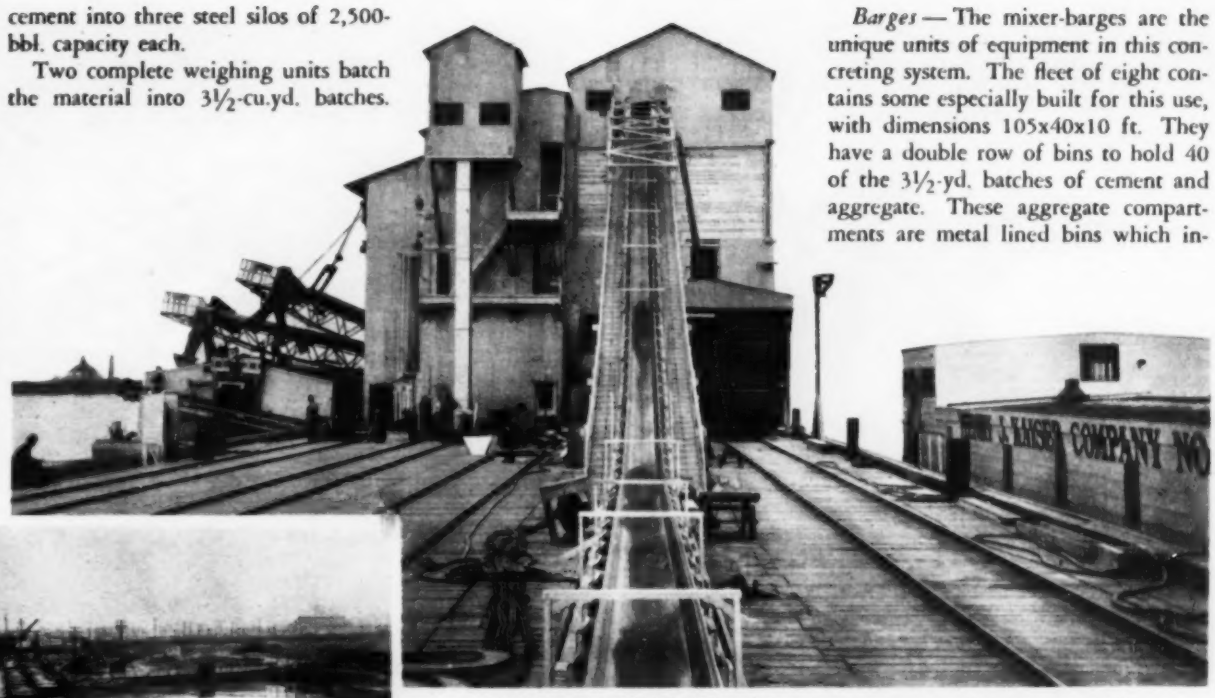
is available for tying up the barges.

Aggregate in three sizes (sand, stone ¼ to 1½ in. and stone 1½ to 2½ in.) is delivered by train from local commercial pits. Each of the three tracks is provided with a track-hopper which feeds on to a 30-in. gathering belt, at right angles to the tracks, discharging on the main conveyor belt. The main conveyor unit is a 30-in. belt about 500 ft. long which delivers the material to the storage bins. The first section is on an upgrade to the wharf level, then, for about 200 ft. the belt runs horizontal and finally rises to the plant. At the end of the main conveyor, a shuttle belt on a turntable over the bins provides for distributing the aggregate into the proper storage. The troughing rolls and idlers at the plant are Link-Belt equipment.

Cement is delivered in bulk and unloaded into a track hopper from where a screw conveyor moves it horizontally to a bucket elevator with a 60-ft. lift. A second screw conveyor distributes the cement into three steel silos of 2,500-bbl. capacity each.

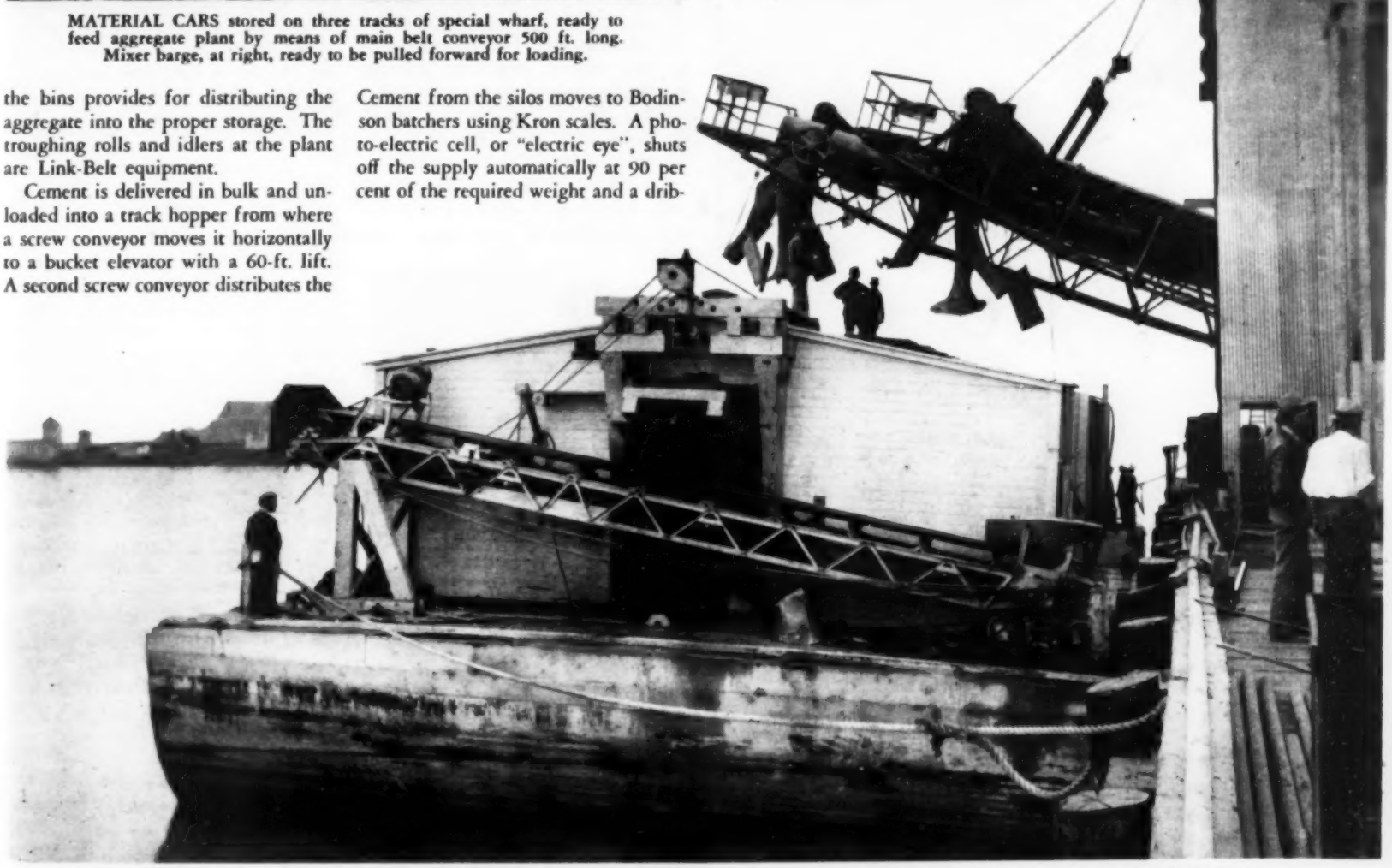
Two complete weighing units batch the material into 3½-cu.yd. batches. Cement from the silos moves to Bodinson batchers using Kron scales. A photo-electric cell, or "electric eye", shuts off the supply automatically at 90 per cent of the required weight and a dribble feeder completes the measurement. The aggregate is weighed separately in two Bodinson batchers. Each of the two batching units feeds to a conveyor belt system (separate belts for cement and aggregate) which extends out over the edge of the wharf and discharges directly into the separate batch bins on the barges.

Barges — The mixer-barges are the unique units of equipment in this concreting system. The fleet of eight contains some especially built for this use, with dimensions 105x40x10 ft. They have a double row of bins to hold 40 of the 3½-yd. batches of cement and aggregate. These aggregate compartments are metal lined bins which inclose a separate cylindrical tank for the cement. As the barge is moved along under the discharge belts from the batchers, the load of 40 batches is put aboard. In the meantime, the water



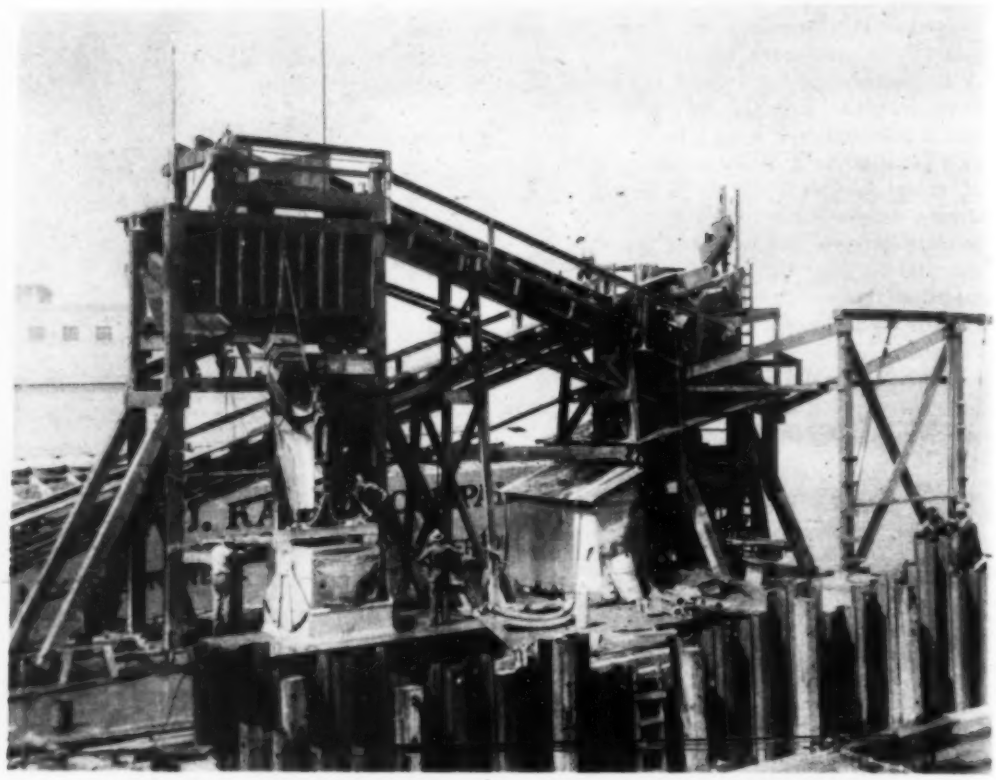
AGGREGATE BATCHING PLANT of Henry J. Kaiser Co., on Oakland side of bay, proportions and loads on barges concrete material for bridge pier foundations. Note main belt conveyor, at center, and barge being loaded, at left.

MATERIAL CARS stored on three tracks of special wharf, ready to feed aggregate plant by means of main belt conveyor 500 ft. long. Mixer barge, at right, ready to be pulled forward for loading.

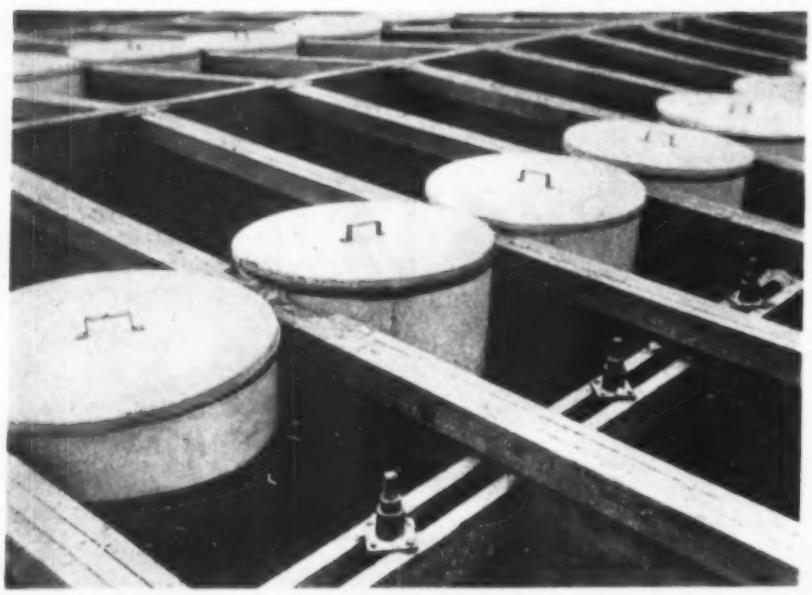


MIXER BARGE is equipped at end with movable shuttle belt which receives concrete from mixer and discharges it into buckets or elevating belts. This view shows belt conveyor in position for towing of barge. When delivering concrete, belt, with lower end mounted on wheels, is moved toward left, so that discharge end overhangs side of barge, to discharge into buckets or on to another belt.

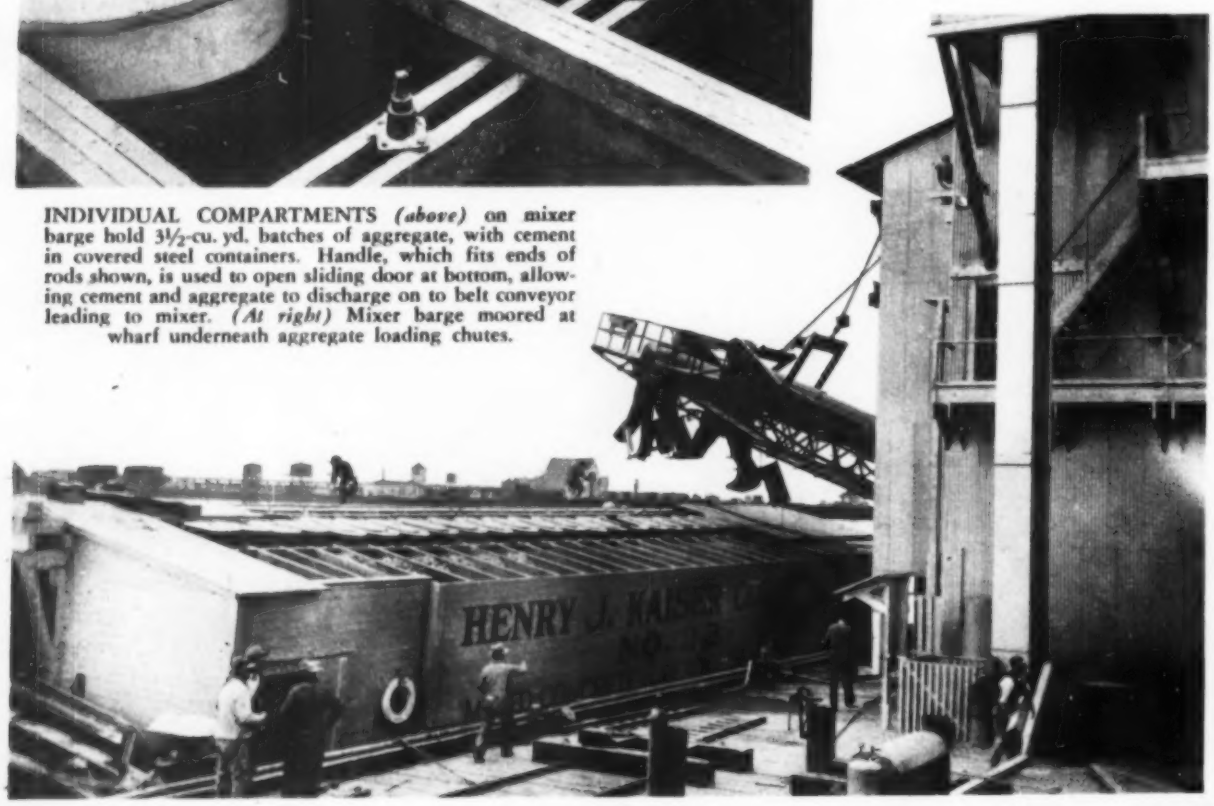
DETAILS of belts and chutes for loading batches into barges and also, at bottom, belt for discharging concrete received from mixer at other end of barge.



CONCRETING PLANT of Transbay Construction Co. at pier No. 2, San Francisco end of bridge. From concrete mixer barges concrete is elevated by double lift of conveyor belts on second barge and dumped through hopper into buckets.



INDIVIDUAL COMPARTMENTS *(above)* on mixer barge hold 3½-cu. yd. batches of aggregate, with cement in covered steel containers. Handle, which fits ends of rods shown, is used to open sliding door at bottom, allowing cement and aggregate to discharge on to belt conveyor leading to mixer. *(At right)* Mixer barge moored at wharf underneath aggregate loading chutes.



tanks on the barge are filled. When loaded, the barge is ready to be towed to the pier where concrete is to be placed.

With the exception of preliminary work, the first pour was made to fill the cutting edge of the caisson at pier No. 5 in the east channel for Bridge Builders Inc. Several days later, concrete placing was started at the main tower pier No. 2 at the San Francisco end of the west channel suspension spans, the Transbay Construction Co. contract.

On arrival at the pier site electric connection is established to the power supply available at every construction point. All operations on the barges are completely motorized. Slide gates, operated by extension rods from the top of the bins, permit the individual batches to discharge on the two conveyor belts which extend under each line of bins. These two belts feed the batches to the Rex mixers, of which there are two on some of the barges and four on the larger units. Water from the tanks is accurately measured by meter.

The mixed concrete is discharged on to a common, central conveyor belt which extends back through the barge to the other end. This belt elevates the concrete from the low point of mixer discharge and feeds on to the final short shuttle belt. This belt has a swing of almost 180 deg. and a range in elevation so that it can discharge either into 4-cu.yd. Blaw-Knox bottom-dump buckets for final placement or to a second barge equipped with another system of belts to elevate the concrete still further for more convenient handling.

The use of the double conveyor belt system on the mixer barges, necessitating the moving of the mixed concrete the entire length of the barge, eliminates the need for a direct elevator or hoist.

Organization—The entire concreting system was developed by the Henry J. Kaiser Co., of which Henry J. Kaiser is president and A. B. Ordway, general manager. H. P. Davis was in charge of plant design.

The San Francisco-Oakland Bay Bridge is being built by the California Toll Bridge Authority under the general direction of Earl L. Kelly, state director of public works. C. H. Purcell is chief engineer, C. E. Andrew, bridge engineer and G. B. Woodruff, engineer of design.

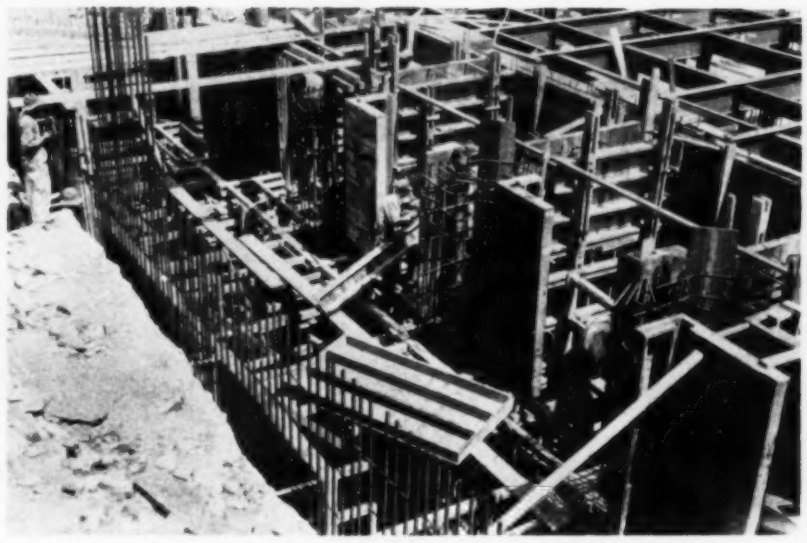
Concreting Methods Aid Construction of

WATERWORKS PLANT

EFFECTIVE DESIGN and handling of concrete forms and a compact central mixing plant with adequate reserve supplies of raw materials contributed to the successful execution of the contract for the Meander Creek 40-m.g.d. water purification and pumping works, built for the Mahoning Valley Sanitary District, by the Clemmer-Noah Construction Co., of Akron, Ohio, to supply clear, soft water to the cities of Youngstown and Niles, Ohio. The contractor's excavating and material-handling methods likewise were important factors in carrying the work to a satisfactory conclusion.

Water Treatment Plant—The comprehensive water-supply program of the Mahoning Valley Sanitary District, now completed, called for a dam on Meander Creek, about 7 mi. west of Youngstown and about 2 mi. south of Niles, and a water treatment and pumping station at the same site delivering through force mains to a distributing reservoir in Youngstown and to a standpipe in Niles. Water from the new system replaces the unsatisfactory supply formerly drawn from the Mahoning River. An article in the October, 1931, issue of *Construction Methods* described the construction of the distributing reservoir.

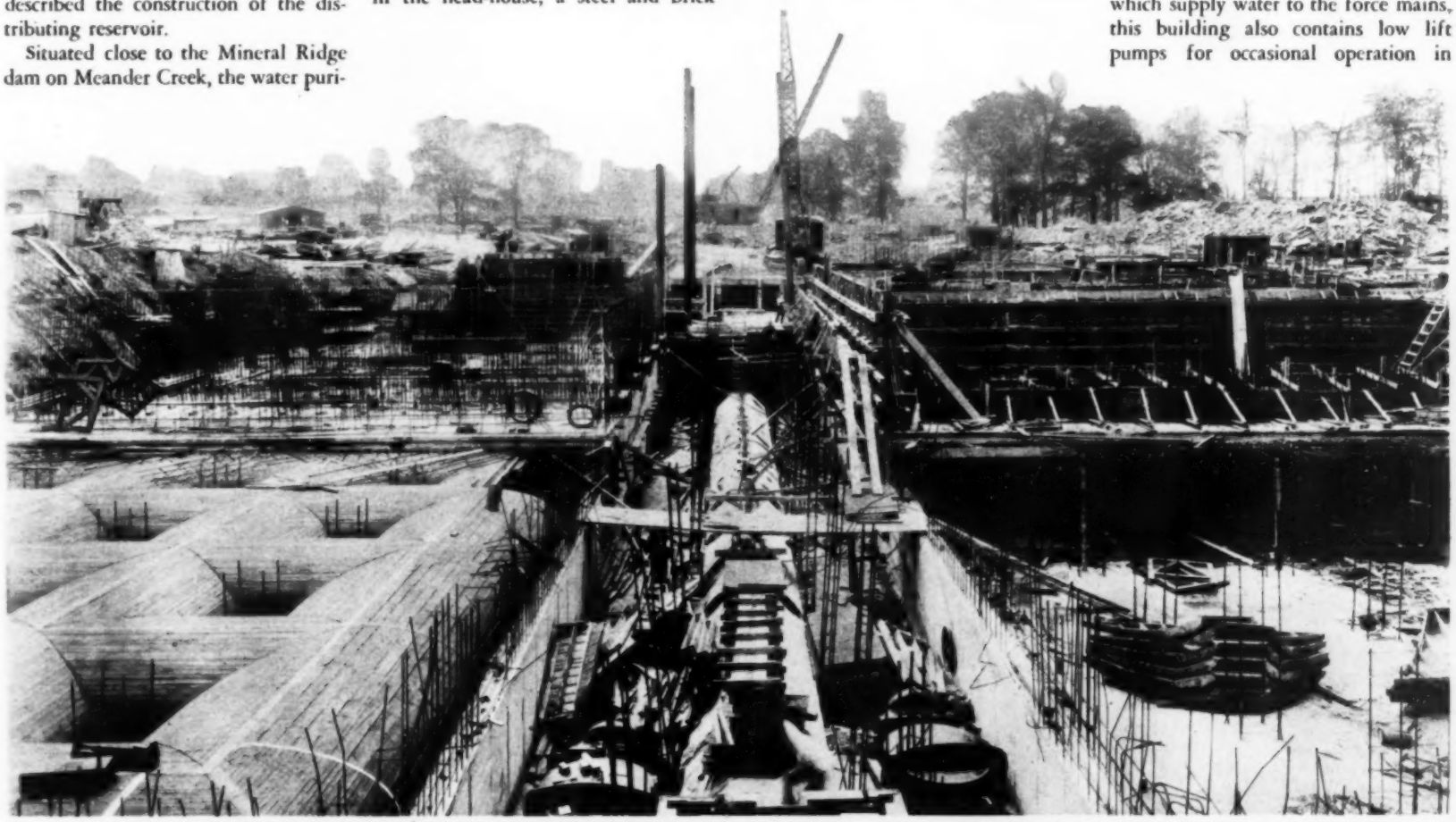
Situated close to the Mineral Ridge dam on Meander Creek, the water purification and pumping works comprise three main elements: (1) a preliminary treatment plant; (2) rapid sand filters; (3) a pumping station. The preliminary treatment plant consists of a head-house for storing chemicals, four mixing chambers and four settling basins equipped with Dorr clarifiers. Inclosed in the head-house, a steel and brick structure about 115 ft. high, are eight concrete storage bins with a gross capacity of 700 tons, arranged to provide about 3 weeks' supply of chemicals for a plant output of 40 m.g.d. The four mixing chambers are arranged in pairs on the north and south sides of the head-house between settling basins. Each settling basin measures 110x110 ft. in outside plan dimensions and has a minimum depth at high water of 13 ft. Maximum depth of excavation required at the center of the settling basin was more than 24 ft.



SECTIONAL PANEL FORMS serve construction of angular interior piers and walls as well as unbroken concrete surfaces of main walls.

Rapid sand filters in ten units are arranged in double rows over clear-water wells of groined arch construction having a total capacity of 1,000,000 gal. Each filter unit has a capacity of 4 m.g.d. The rapid sand filters are divided into two groups of five units each, with a pipe gallery between. Over the filters is a steel and brick building, with a raised center section above the pipe gallery covering the operating floor and connecting with the administration building at the south end of the filter layout. This latter building, of concrete, steel and brick construction, contains the plant laboratory and large wash water tanks for cleaning the sand filters. The filters occupy an area 148 ft. by 142 ft., and the administration building measures 87 ft. by 45 ft. in plan.

Maximum plan dimensions of the pumping station, another building with concrete substructure and brick and steel superstructure, are 155 ft. by 122 ft. In addition to the high lift pumps which supply water to the force mains, this building also contains low lift pumps for occasional operation in



WOOD FORMS (left) for groined-arch construction of clear-water wells under rapid sand filters are fabricated in job shop. Reinforcing steel and wall forms for some of the filters appear in background. Farther back, crane is erecting steel columns of administration building. Pipe gallery divides two groups of filters. Each of ten filter units has capacity of 4 m.g.d.

pumping from the reservoir when the water level is low. All pumps are electrically operated. The pumping station houses screens for initial cleaning of raw water before delivery to the preliminary treatment plant.

Construction Quantities — Total excavation for the project amounted to 44,000 yd. of earth and 55,000 yd. of rock, principally sandstone and shale. Of this total, trench excavation accounted for 9,000 yd. in earth and 7,000 yd. in rock. Concrete in foundations and superstructures aggregated 25,000 yd. and required 1,300 tons of steel reinforcement. Structural steel in the buildings amounted to 1,000 tons.

Excavation — A Keystone skimmer stripped 7,000 yd. of topsoil, and a Keysone trench hoe removed 15,000 yd. of earth and rock from sewer and conduit trenches about the plant. Two Thew Lorain 1¼-yd. gasoline shovels excavated 35,000 yd. of earth and loaded 48,000 yd. of rock after it had been drilled and blasted. Following the first step of roughing out the rock foundations by blasting and excavating, workmen trimmed the rock walls to the exact outside dimensions of the building substructures. Three Ingersoll-Rand portable compressors supplied air to eight pneumatic chippers employed in this work. Concrete for foundation walls was placed directly against the rock, forms being required only for the inside surface.

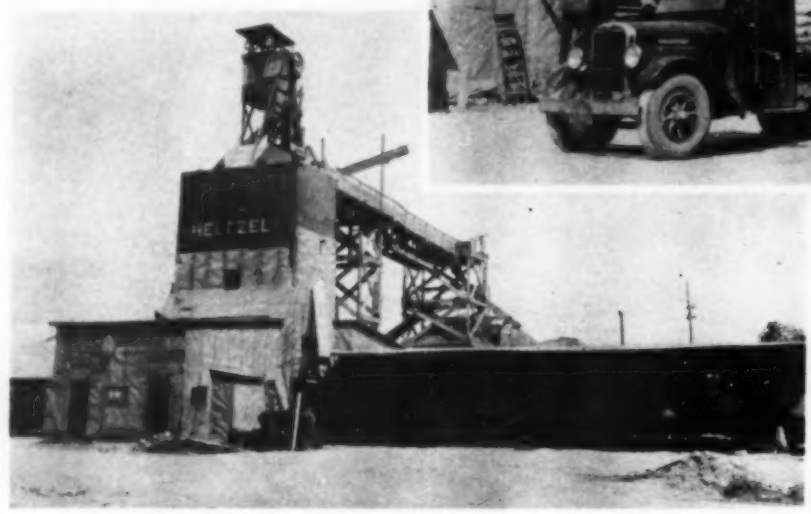
Some of the excavated material was used in constructing a level fill surrounding the units of the plant. In building this fill and in constructing roads and embankments for an elevated railway spur, the contractor used a Caterpillar 30-hp. tractor equipped with a bulldozer, two 10-ton road rollers and an automotive blade grader.

Concrete Mixing Plant—Daily concrete requirements varied from 100 to 500 yd. To supply the maximum requirements, the contractor erected a concrete plant equipped with two Knickerbocker 1-yd. mixers beside a temporary double-track railroad spur and installed a unique arrangement of storage bins and conveyors to make a large reserve supply of raw materials readily available at this plant. Materials were handled by a sort of circulatory system, which transferred excess supplies of aggregates temporarily to reserve storage bins. These reserves later were discharged again on to the conveyor carrying materials to the bins above the mixers.

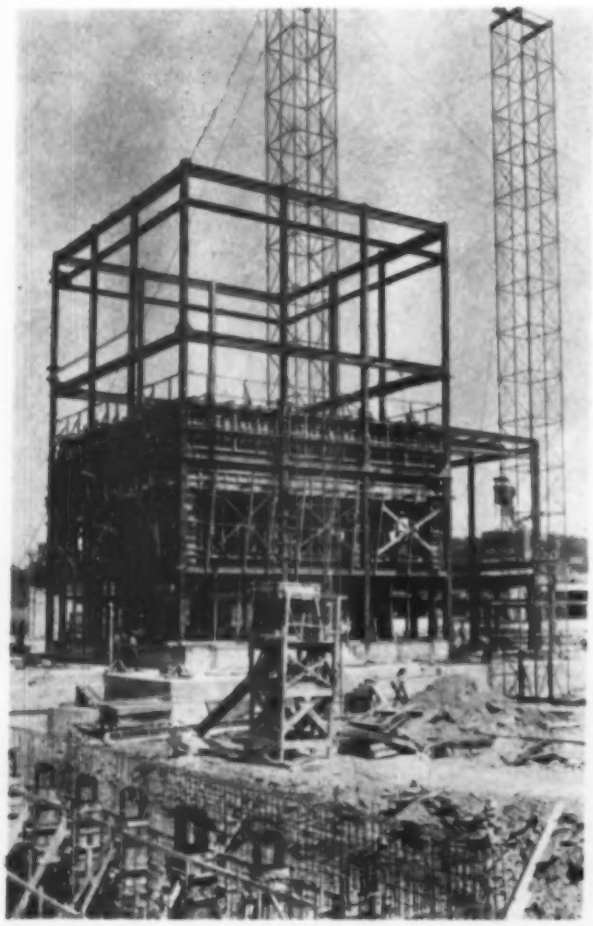
Concrete design called for two sizes of slag. Three-compartment Heltzel steel bins above the mixers provided storage capacity of about two cars each for the two sizes of coarse aggregate and for sand. Hopper-bottom cars on both tracks of the railway spur discharged aggregate on to a broad horizontal conveyor belt traveling in a tunnel beneath the tracks. The belt delivered to the boot of a bucket chain elevator, which raised the aggregate and discharged it into the proper compartment of the steel bins. Excess material was diverted from the top of the bucket chain elevator on to an elevated belt conveyor which carried the aggregate across the tracks and deposited it through a chute into the proper storage pile. These storage piles, situated across the tracks from the mixing plant, fed materials as required back on to the wide belt in the tunnel under the tracks.

Sack cement was hauled by truck under contract 16 mi. from the mill and was stored in a large shed at the mixing plant. A small bucket elevator raised

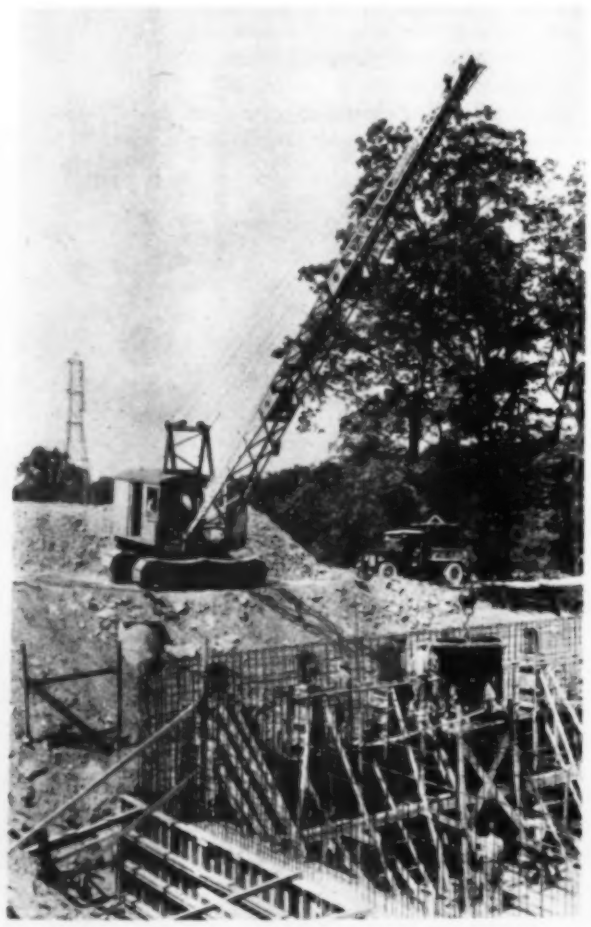
TRUCK AND TRAILER *(right)* deliver large load of sack cement hauled 16 mi. from mill. CONCRETE MIXING PLANT *(below)* is supplied with aggregate from hopper-bottom cars by tunnel conveyor and bucket elevator. Excess aggregate is carried by belt across overhead bridge to far side of tracks, later to be reclaimed by tunnel conveyor.



S. N. VANCE (left), resident engineer, and C. E. CURTIS, construction superintendent.



HEAD-HOUSE SUPERSTRUCTURE has steel frame supporting concrete bins. Two tower elevators deliver concrete and brick to upper levels.



CRANE-AND-BUCKET METHOD of concrete placement affords flexibility in distribution. Light trucks haul 1-yd. buckets from mixing plant.

MAZE OF REINFORCING STEEL is installed before forms are erected at pump house. Pipe sections are placed in wall reinforcement. Note how rock walls in background have been trimmed to exact dimensions, eliminating need for outside wall forms.

the cement from the shed to the weighing platform.

Formwork — Sectional forms were used wherever possible on the work, it being found economical by the contractor not only to build the forms for flat surfaces in 4x8-ft. rectangular panels but also to fabricate in a woodworking shop the special forms for the groined and barrel arches. A small woodshop was erected near the end of the railroad spur and was equipped with power-driven cross-cut, rip and band saws. The mechanics made up a number of panel forms which were coated on the face with paraffin oil and stored in a yard adjacent to the shop until needed.

Form panels were held in place by double 2x6-in. wales on 2-ft. centers, with ⅝-in. tie bolts and 1-in. wood spreaders between the forms. After stripping, damaged panels were returned immediately to the wood shop for repairs. Where rock excavation had been trimmed to the neat line of the foundation wall, forms had to be erected and braced on one side only.

Concrete Distribution — Concrete was hauled from the mixing plant by Ford trucks in 1-yd. Dravo bottom-dump buckets which were handled into substructure forms by a 5-ton Northwest gasoline crane with a 70-ft. boom. In places which the crane could not reach, short sections of chutes were employed to place the concrete. The small quantities of concrete required in the upper portions of the three main buildings were hoisted by tower elevators. Distribution by bucket afforded great flexibility in delivering to several points simultaneously and assured desirable batch-to-batch uniformity in the concrete.

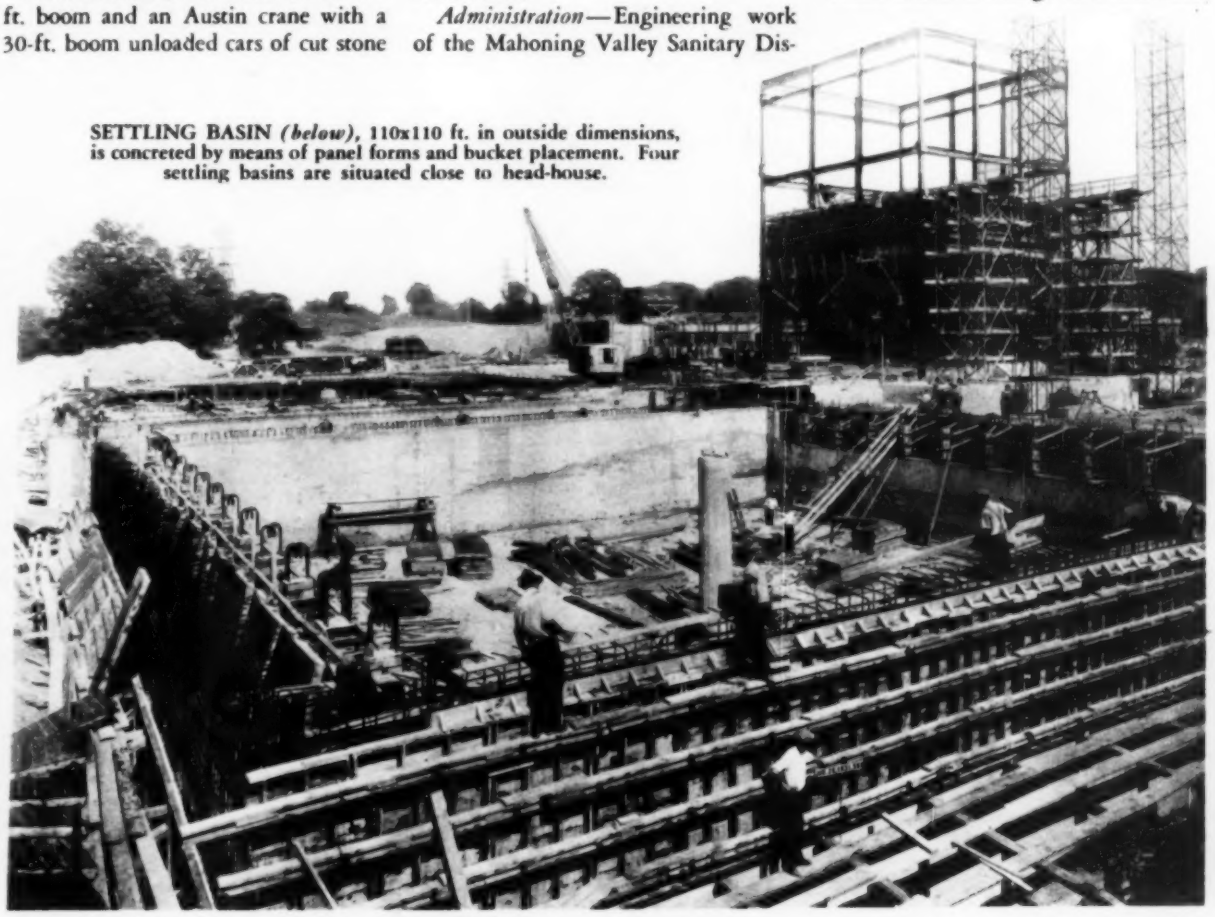
Superstructure Masonry—Three elevators in tubular steel towers, two of them operated by electric hoists, one of 25 hp. and the other of 35 hp., and the third by a 35-hp. gasoline hoist, were used at the three main buildings to deliver superstructure materials. These buildings have brick exterior walls trimmed with cut stone. At the head-house, the bricklayers worked on a suspended scaffold.

A Northwest 5-ton crane with a 50-ft. boom and an Austin crane with a 30-ft. boom unloaded cars of cut stone trim and also handled form panels about the job. At the pumping station, an American steam crane with a 100-ft. boom handled forms, concrete, reinforcing and structural steel, and, in addition, spotted various heavy castings and pieces of equipment. This crane, with its boom length increased 50 ft. by a wood extension trussed with four hog rods, erected light structural steel members in the upper portion of the head-house.

Administration—Engineering work of the Mahoning Valley Sanitary District was under the direction of W. H. Dittoe, chief engineer, and G. Gale Dixon, deputy chief engineer. In charge of construction at the purification works was S. N. Vance, resident engineer, with Bruce A. Barr as principal assistant.

For the Clemmer-Noah Construction Co., of Akron, Ohio, C. E. Curtis, superintendent, supervised the work. The Roberts Filter Co., of Darby, Pa., was contractor for the filter equipment, with Vibert Davis in charge of installation.

SETTLING BASIN *(below)*, 110x110 ft. in outside dimensions, is concreted by means of panel forms and bucket placement. Four settling basins are situated close to head-house.



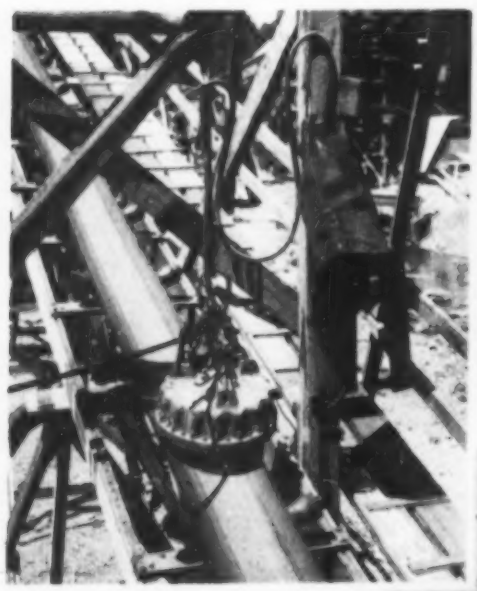
Getting Down to
DETAILS

Close-up Shots of
Job Methods and Equipment

VIBRATED SCREED *(right)* is used by Peter di Antonio, contractor, of Trenton, N. J., on paving state highway in that city. Munsell vibrator is 8-in. channel 11 ft. long, equipped with two eccentric rotors operated at from 3,000 to 4,000 r.p.m. by compressed air at 90-lb. pressure. Total weight of vibrating screed is 300 lb. Latest New Jersey state specifications require vibration of concrete in pavement slabs.

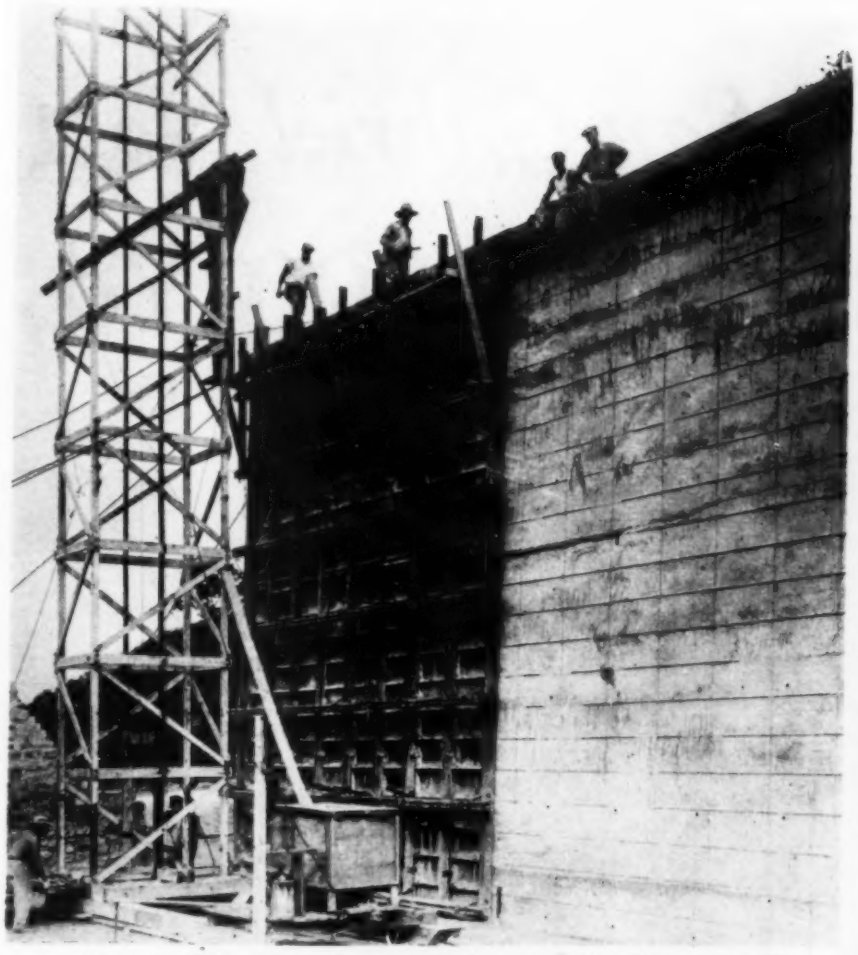
PNEUMATIC-TIRED WHEELBARROWS are used by Eastholm-Melwin Co., contractor, to deliver concrete for new Field Building in Chicago. Cushioning effect of Goodyear tires carrying 40 lb. of air, eliminates necessity for planking over tile floors.

BLASTING CANOPY *(left)* to intercept flying rock, devised by W. M. Carrier, of Flint, Mich., is large wood box with closed top and no bottom, providing air space to cushion explosion and muffle sound. Bolted frame of 6x6-in. oak timbers, forming box 16 ft. square and 22 in. deep, is double floored on top. Device is placed and moved by chain from power shovel dipper. *Photo from* BUCYRUS-ERIE CO.



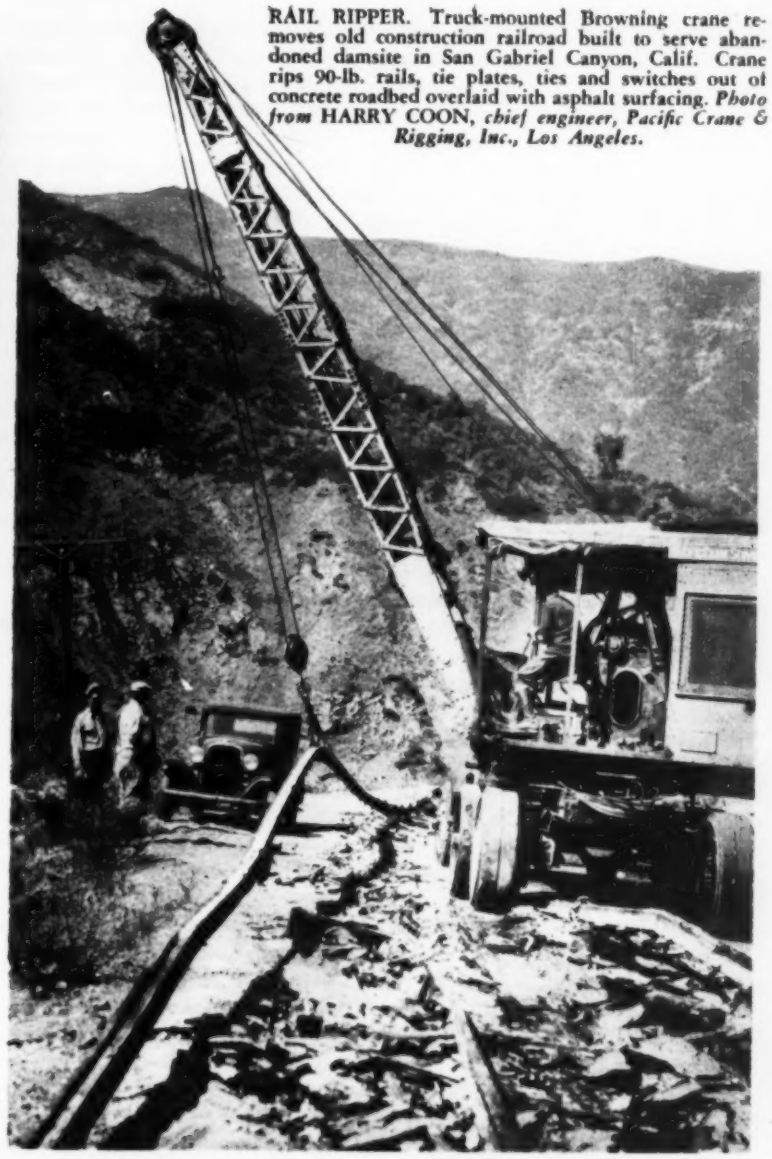
ELECTRIC MAGNET hung over belt conveyor removes tramp iron from aggregate crushed from tunnel muck at Quabbin Reservoir job for Boston water supply. Contractor, Wenzel & Henoch Co., of Milwaukee.

MOTOR BUSES *(right)* transport construction workers to and from Dam No. 3 on the Tennessee River 20 mi. above Muscle Shoals. By providing transportation Stevens Bros. and Miller-Hutchinson Co., contractors, of New Orleans, eliminate housing at job site. Buses handle men working four shifts daily on 30-hr. week basis.



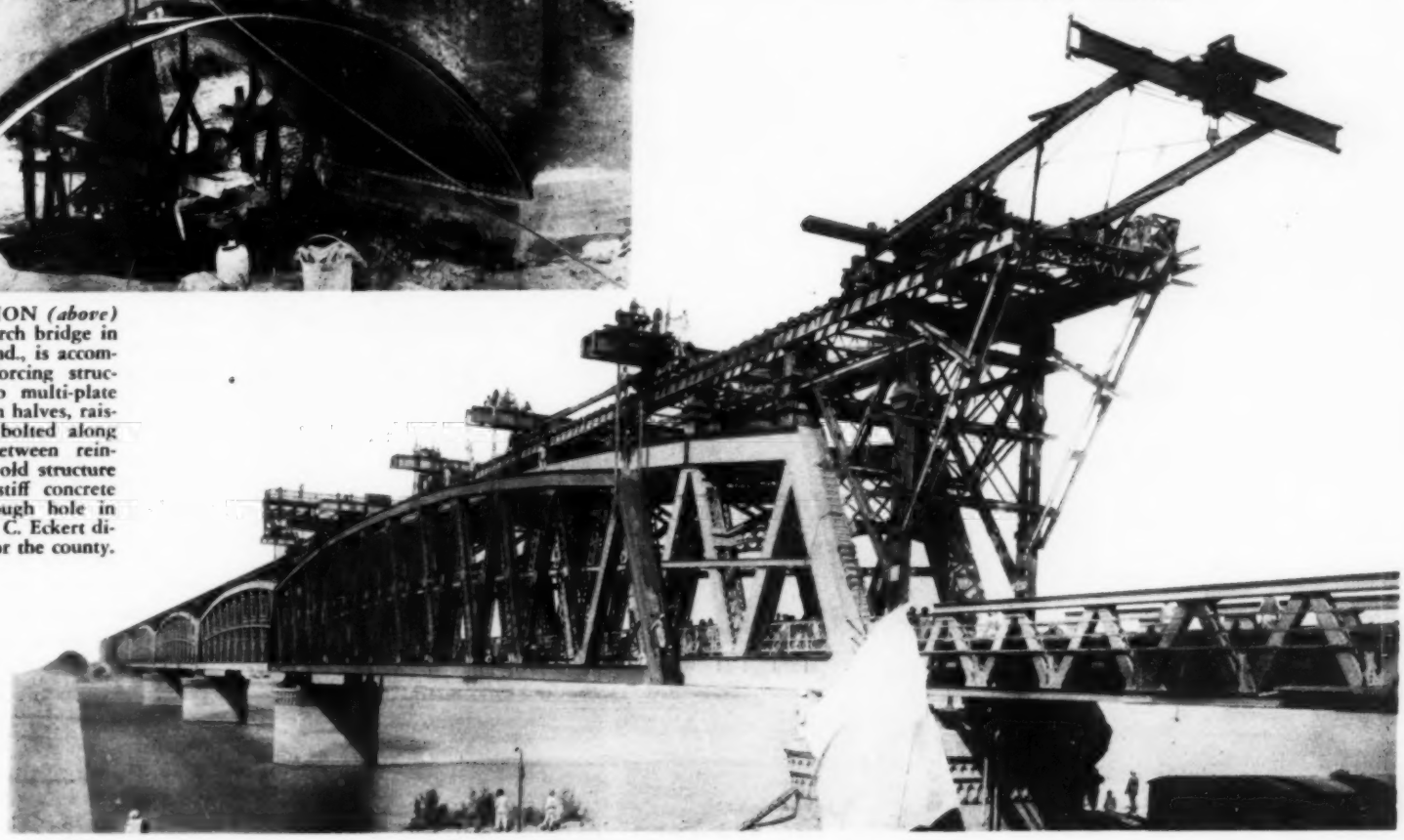
STEEL LINING PANS make up forms for construction of concrete walls 30¼ ft. high at Iowa State Penitentiary, Fort Madison, Iowa. Truscon steel pans, each 36x16 in. in area, have 2-in. flanges containing holes for bolting sections together. Walls taper in thickness from 3 ft. at base to 18 in. under overhanging coping. Forms are constructed with 2x6-in. uprights and double 2x8-in. wales. Scaffold walkway at top of forms provides working platform for placing and finishing concrete.

RAIL RIPPER. Truck-mounted Browning crane removes old construction railroad built to serve abandoned damsite in San Gabriel Canyon, Calif. Crane rips 90-lb. rails, tie plates, ties and switches out of concrete roadbed overlaid with asphalt surfacing. *Photo from* HARRY COON, *chief engineer, Pacific Crane & Rigging, Inc., Los Angeles.*



REHABILITATION *(above)* of old concrete arch bridge in Ripley County, Ind., is accomplished by reinforcing structure with Armco multi-plate arch, assembled in halves, raised to place and bolted along crown. Space between reinforcing arch and old structure is packed with stiff concrete and grouted through hole in top of old arch. J. C. Eckert directed the work for the county.

SERIES OF TROLLEYS *(below)* electrically driven on track on top chord of existing trusses, carried two 360-ft., 200-ton trusses for strengthening Indus River Bridge in India. Extra main trusses are placed outside those of existing five 360-ft. spans. After new trusses had been rolled into position electric gantry used temporary tracks to erect new railway floor and cantilevered roadways.



San Gabriel No. 1

5,600,000 Yd.

CONCENTRATING WORK on the diversion tunnel, stripping of the site and preparation of the quarry, the West Coast Construction Co. is making rapid progress on the preliminary work for the record-breaking San Gabriel No. 1 Dam in California. This unprecedented rockfill structure, 370 ft. high from bottom of cutoff, is being built by the Los Angeles County Flood Control District on the San Gabriel River for the joint function of flood control and water conservation. The contract for $8,600,000 was signed in January and completion is called for in 5½ years.

The dam consists of the usual main body of dumped rock with a section of placed rock on the upstream face which will be covered by a laminated Gunite facing. The upstream slope varies from 1.3:1 to 1.4:1 and the downstream slope increases from 1.3:1 at the crest to 1.6:1 at the toe. The base thickness is about 900 ft. and the crest is almost 1,700 ft. long. The dam will require the placing of 5,600,000 cu.yd. of rockfill and 120,000 cu.yd. of concrete and Gunite.

Diversion Tunnel—The driving of a 30-ft. diameter diversion tunnel through the east abutment was the first construction operation. This 2,000-ft. tunnel will have a heavily reinforced concrete lining 2 ft. thick and after serving as the diversion tunnel will become the permanent outlet from the reservoir.

Excavation started from both portals in March, the upstream portal using a center heading, because of the elevation of the water surface and the downstream portal using a 14x14-ft. bottom heading. Average progress on these pioneer bores was 20 ft. per day per heading. Only 84 ft. of timbering was required in the entire tunnel length and no portal timbering was necessary. Three shifts were used in both headings for the pioneer work and an 8-ft. round was used with 9-ft. holes. Worthington-Gilman pneumatic feed drills are used.

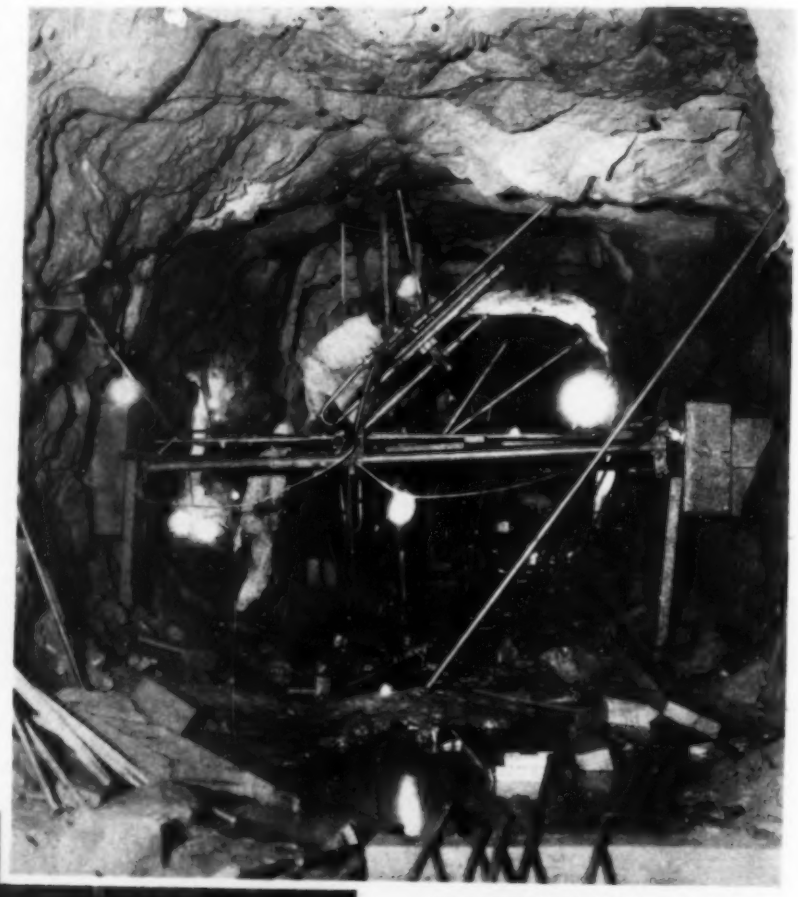
Enlargement to the rough diameter of 34 ft. on the north or upstream portal is being done by ring drilling, using a horizontal bar and one Worthington drill, as illustrated. Muck from this operation is loaded by a 1¼-yd. air-operated shovel into trucks. The downstream heading, driven with the bottom heading, is being enlarged by stoping into mine cars.

The rock is an excellent granite with an average weight of 175 lb. per cu.ft. and a strength of 12,000 lb. per square inch on 3-in. cube specimens. This point is of interest as indicating the general character of local rock which can be obtained for the fill. Preliminary figures indicate that the tunnel overbreak beyond the pay line will average about 6 per cent. The explosives have averaged about 4 lb. per cubic yard in the pioneer heading and 2½ lb. per cubic yard in the enlargement work. The usual shops and equipment were established for this work, including a single compressor house, equipped with three Sullivan units, for both portals.

Tunnel muck from the upstream heading is being used to construct a cofferdam downstream from the portal which will connect with a concrete cutoff to bedrock and serve as a diversion dam during the construction period.

Concrete Lining—The concrete plant for lining the tunnel will consist of two 1-yd. mixers with weighing equipment for the aggregate. Local river gravel from the vicinity will be developed for the concrete. Placing of the 2-ft. thickness of lining behind 30-ft. steel forms mounted on tracks will be done with a concrete gun. The lining is reinforced with 424 lb. of steel per linear foot, or 57 lb. of steel per cubic yard of pay-concrete lining.

The tunnel excavation and lining operations were subcontracted by the West Slope Construction Co. to Morrison & Knudsen Co.; J. B. Bonny is district manager and F. E. Stokes is



PIONEER DRIFT of diversion tunnel from upstream portal is 10x14-ft. center heading because of water problem. Enlargement is done by ring drilling. Muck from enlargement is loaded into trucks by air-operated shovel.

WEST ABUTMENT *(below)* overburden excavation is handled by power shovels and trucks. Average haul is 1,000 ft. and dump can be seen upstream (at right) from damsite on canyon wall.

Dam to Contain of Rock Fill

BOTTOM HEADING, 14x14 ft. in size, is driven from downstream portal of diversion tunnel and enlarged to full 34-ft. diameter section by stoping into 3-cu.yd. mine cars.

superintendent for this tunnel work.

Abutments—The east abutment for the dam consists of a steep wall of rock with an average slope of about ½:1. Removal of loose material from this wall was done with a Byron-Jackson four-stage pump and a hydraulic giant with 2½-in. nozzle under a maximum pressure of 200 lb. This sluicing operation has proved sufficient preparation for the abutment except for the excavation of the cutoff and final trimming, which will be carried on progressively as the fill is made.

On the west abutment the overburden is being removed by shovel and truck operation which averaged during the month of June about 1,150 yd. per 8-hr. shift. With an average haul of about 1,000 ft., this material is deposited upstream from the damsite and used to blanket the slope below the proposed spillway cut. This rough excavation of the west abutment is about completed and the remaining work will be done as the rockfill rises. Of the estimated total of 400,000 yd. to be removed, 178,000 yd. were taken off by July 1. The contract figure is 48 c. per yard for this work. Three small-sized Bucyrus-Erie shovels were used for this excavation, with the assistance of Allis-Chalmers tractors equipped with bulldozers and trucks.

In the streambed the removal of sand, gravel and boulders is at present in progress with two 4-yd. Bucyrus-Erie shovels loading into 10- and 20-yd. trucks. The average haul is about 1,000 ft. to the dump upstream from the damsite. This equipment is averaging about 2,250 yd. per 8-hr. shift. Along the upstream cutoff granite bedrock has been exposed, ranging from 20 to 70 ft. below original streambed level.

Quarries — According to specifications, the rockfill is to be obtained from a number of designated quarry sites selected by the district. Bids for rock prices were separate for each quarry and the district pays the contractor unit prices for quarry stripping, waste and rock placed in the dam.

The closest quarry site, designated as No. 10, is about ½ mi. downstream from the center line of the dam and is now being stripped. Present plans call for placing of rockfill about March, 1934, which is the scheduled date for completion of streambed excavation. The quarry has a sheer face of about 350 ft. and will be opened up along a 1,000-ft. length on the streambed elevation. The quarry face is triangular and has an additional rise of 250 ft. on a flatter slope.

Contract prices per cubic yard for quarry work in this No. 10 quarry are: Stripping, measured in original place, $0.55; Waste, measured in waste dump, $0.40; Quarried rock: Class A, in body of dam, $0.75; Class B, in body of dam, $0.40; Class C, downstream face, $1.20; Class D, placed on upstream face, $2.45.

Making allowance for the estimated swell in the waste dump, as compared with measuring the stripping on the original ground, the contract prices for stripping and waste are about the same. On July 1 about 137,000 cu.yd. of stripping and waste had been removed from this quarry site out of the estimated total of 3,000,000 cu.yd.

The West Slope Construction Co. is a consolidation of contracting firms, including Foley Bros., Inc., St. Paul; Bates & Rogers Construction Co., Chicago; J. C. Maguire and the Lawler Corp. D. A. Daly is general superintendent, D. B. Cassell, treasurer, E. S. Whitney, field superintendent, and B. E. Barnhill, chief engineer.

E. C. Eaton is chief engineer of the Los Angeles County Flood Control District and has general supervision over this project and also San Gabriel dam No. 2, now nearing completion. H. E. Hedger is office engineer and N. B. Hodgkinson, chief designing engineer. K. J. Harrison is resident engineer.

DAMSITE *(below)* for record-breaking rockfill of 5,600,000 cu.yd. for Los Angeles County Flood Control District. Location of diversion tunnel through east abutment is indicated, with streambed excavation in progress and quarry stripping started on far canyon wall (at upper right corner).

Lock Built Within CELLULAR COFFERDAM

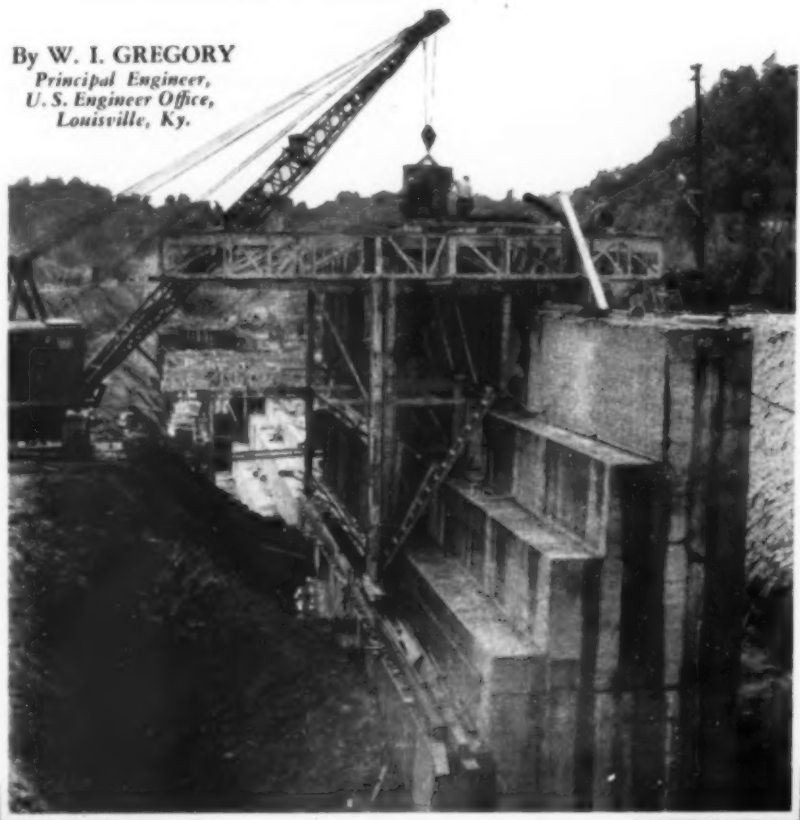
By W. I. GREGORY
Principal Engineer, U. S. Engineer Office, Louisville, Ky.

LOCK No. 1, Barren River, at Greencastle, Ky., 15 mi. above the mouth of the river and 165 mi. from the mouth of Green River, a tributary of the Ohio, is 56 ft. wide, 360 ft. long and has a lift of 15.8 ft. The new lock is constructed on a pile foundation on the land side of an old lock built by the state about 100 years ago. The contract involves 265,000 cu. yd. of excavation, 113,000 lin. ft. of round timber piles, 48,000 sq. ft. of permanent steel sheetpiling, 40,500 cu. yd. of concrete, and 488,000 lb. of structural steel. The job was awarded to G. L. Tarlton, contractor, of St. Louis in February 1933, the amount of the contract being about $578,000. Spoil area for the excavation was provided by the Government on the reservation near the site. The excavation was made by the George C. Bolz Dredging Co., subcontractor, with a 15-in. electrically driven suction dredge.

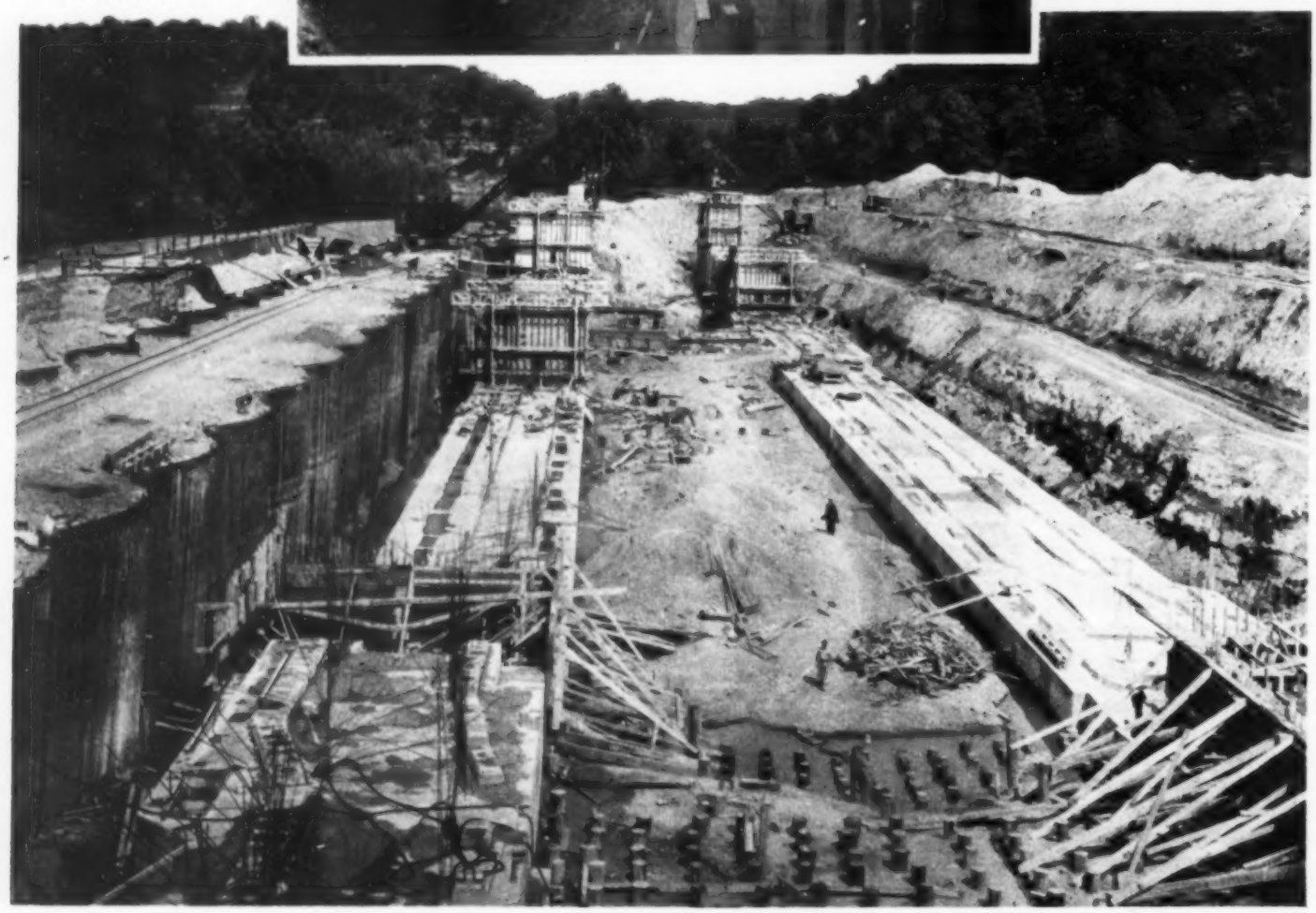
The lock site is inclosed in a cellular cofferdam in which Carnegie steel sheeting 44 ft. long was used. The upper and lower guide walls are being built in unsheeted trenches, draining into the main coffer. The concrete aggregates dredged from the bars of the Barren River are towed to a dock adjacent to a central concrete plant located at the upper end of the work, where they are unloaded into bunkers with a 15-ton American Hoist & Derrick Co. crane. Universal Atlas portland cement, sacked, is shipped in covered barges to the plant from Evansville, Ind. The sacks are broken into a cement bin which is served by a conveyor. The concrete mixing plant is equipped with 3 Johnson weigh-batchers and two 2-yd. Smith mixers. Blaw-Knox 2-yd. buckets transported on cars, are used to convey the concrete from the plant to the monoliths, and cranes are used to handle the buckets to Blaw-Knox forms.

Excellent progress has been made on this job which employs about 325 men. It will be completed in March 1934.

The work is being constructed under the direction of Lieut.-Col. W. A. Johnson, district engineer, U. S. Engineer Office, Louisville, Ky. J. J. Gillmore is the construction superintendent for the contractor. The accompanying photographs were taken six months after actual construction had started.



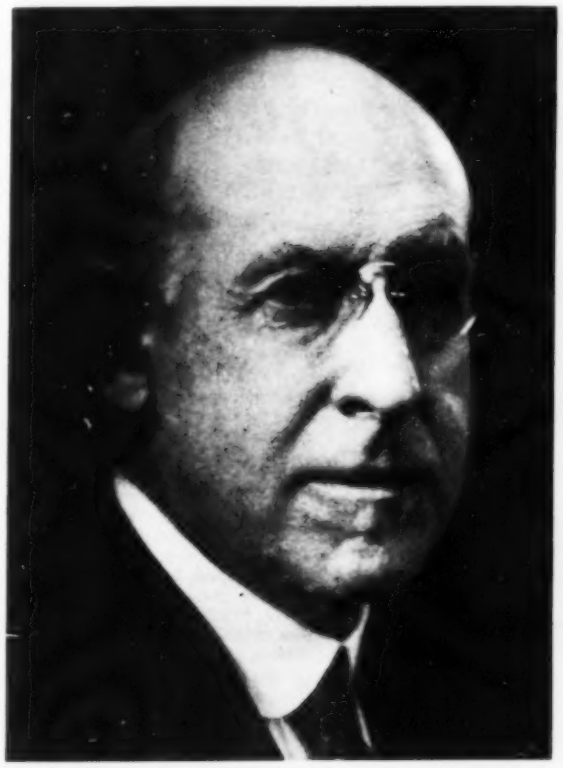
STEEL FORMS *(left)* for lock walls are filled with concrete delivered in 2-yd. bottom-dump buckets, raised from cars by crawler crane.



COFFERDAM *(below)* of cellular, steel sheetpile construction, incloses working area for 56x360-ft. concrete lock.

Present and Accounted For —

A Page of Personalities



CIVIL ENGINEERS' PRESIDENTIAL NOMINEE. Harrison P. Eddy, consulting engineer of Boston and senior member of the firm of Metcalf & Eddy, specialists in waterworks and sewage treatment projects, has been selected by the nominating committee of the American Society of Civil Engineers as its candidate for president, to take office at the annual meeting in January. Mr. Eddy is a former director of the society and has been active in preparing the engineers' code recently submitted to the NRA.

HEADS ROAD BUILDERS. Charles F. Knowlton is serving this year as president of the New England Road Builders' Association. He is president of Simpson Bros. Corp., general contractors, of Boston.

LABOR BOARD'S CHAIRMAN. By appointment of the President, U. S. Senator Robert F. Wagner, of New York, becomes head of the newly created National Labor Board, on which both industry and labor are represented. The chief function of the board will be to compose differences between employer and employee regarding wages and working conditions under the National Industrial Recovery Act.

REGIONAL EXECUTIVE FOR PWA. Morris Llewellyn Cooke, consulting engineer, of Philadelphia, has been appointed by Administrator Ickes to serve as chairman of the Mississippi Valley Committee of the Federal Public Works Administration. The committee will study and coordinate projects recommended for the development of the Mississippi Valley.

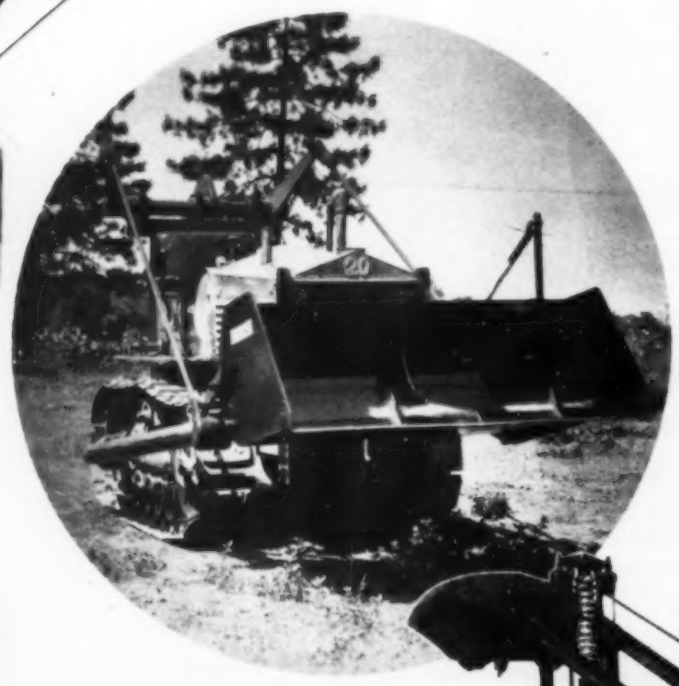
LEADS COLORADO CONTRACTORS. Platt Rogers, general contractor, of Pueblo, is this year's president of the Colorado Highway Contractors' Association. His firm is now engaged in building the Twin Lakes tunnel in that state.

MUNICIPAL ENGINEERS' PRESIDENT. Charles M. Reppert, of Pittsburgh, was elected president of the American Society of Municipal Engineers at its recent annual meeting. Mr. Reppert is chief engineer of the Department of Public Works, Pittsburgh, Pa.

NEW EQUIPMENT *on the Job*

UTILITY CRANE *(below)* attached to Cletrac 20 or 25 forms useful unit for material handling, for regular winch operations or for ordinary tractor purposes. Gooseneck boom of structural steel is raised or lowered by hand winch on A-frame and can reach forward over loads without interference with boom proper. Topping line is 4-part line. Load line is carried from hoist to boom by sheaves and inclosed in pipe guard which eliminates fouling under tractor and interference with load when hoisting. Standard equipment with this unit is 50 ft. of ⅜-in. load line Particularly adapted to loading, unloading and installation operations of contractors, railroads, and utilities.—Commercial Iron Works, Portland, Oregon.

EASY COMPRESSIBILITY and exceptional recovery after extended periods of compression make this cork expansion joint *(below)* a valuable means of compensating for unavoidable expansion and contraction of pavement and structures under varying temperature and moisture conditions. Made of cork particles bound together with phenol formaldehyde type resin. Has lasting resilience of cork wood and chemical permanence of synthetic resin. Unaffected by freezing and thawing. Available in any length up to 20 ft., in standard widths up to 12 in. and in standard thicknesses from ⅛ to 1 in. Net weight about 1.5 lb. per board foot.—Johns-Manville., 22 East 40th St., New York, N. Y.



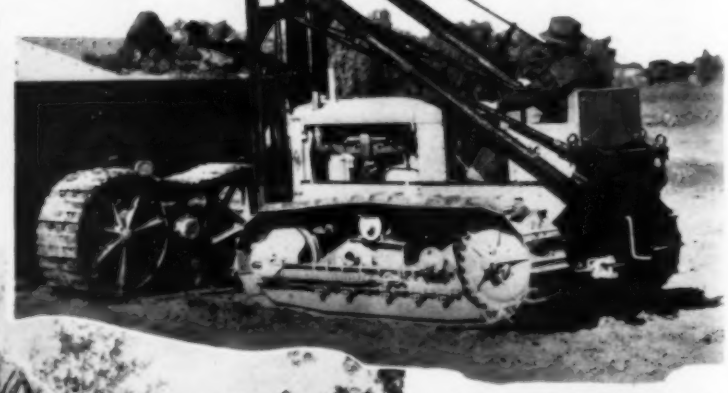
FRONT END LOADER *(left)* handles all kinds of bulk material and is suitable for many types of excavation. Utilizes operating mechanism on rear of tractor as counterbalance. Unit is hydraulically operated and controlled by single lever. Bucket may be held in any position and dumped at any desired height. Since boom is not vertical, loader has low overall height for operation through railroad car doors and like places. Bucket capacities of 14 to 20 cu. ft. For attachment to Cletrac 20, 25 or 35 tractor without any drilling or altering. —Euclid-Armington Road Machinery Co., Cleveland, Ohio.

ADDED TRACTION *(right)* for dual pneumatic-tired tractor, truck or bus provided by J & S Traction Treads enables machines to plow their way through snowdrifts in record time. Valuable also in soft or freshly graded earth where added traction is necessary. Easily and quickly adjustable, having self-locking toggle clamp with turnbuckle adjustment for compensating tire wear or to provide for variation in tire sizes. Pins are large and easily removed. Treads held against tire with sufficient tension to prevent chafing.—W. A. Riddell Co., Bucyrus, Ohio.

If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.



SPECIAL WIDE-GAGE LONG TRACK for spreading weight of machine, and truck frames rigidly mounted to eliminate oscillation provide solid chassis for this front end loader on Allis-Chalmers Model M tractor. Standard 1/3-yd. bucket can be removed and bulldozer installed or larger bucket used for handling snow or other light materials. Unit is hydraulically controlled and completely equipped with counterweights and rear starting crank. Drawbar is clear for use on any pulling work.—Frank G. Hough Co., 919 N. Michigan Ave., Chicago, Ill., or Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis.

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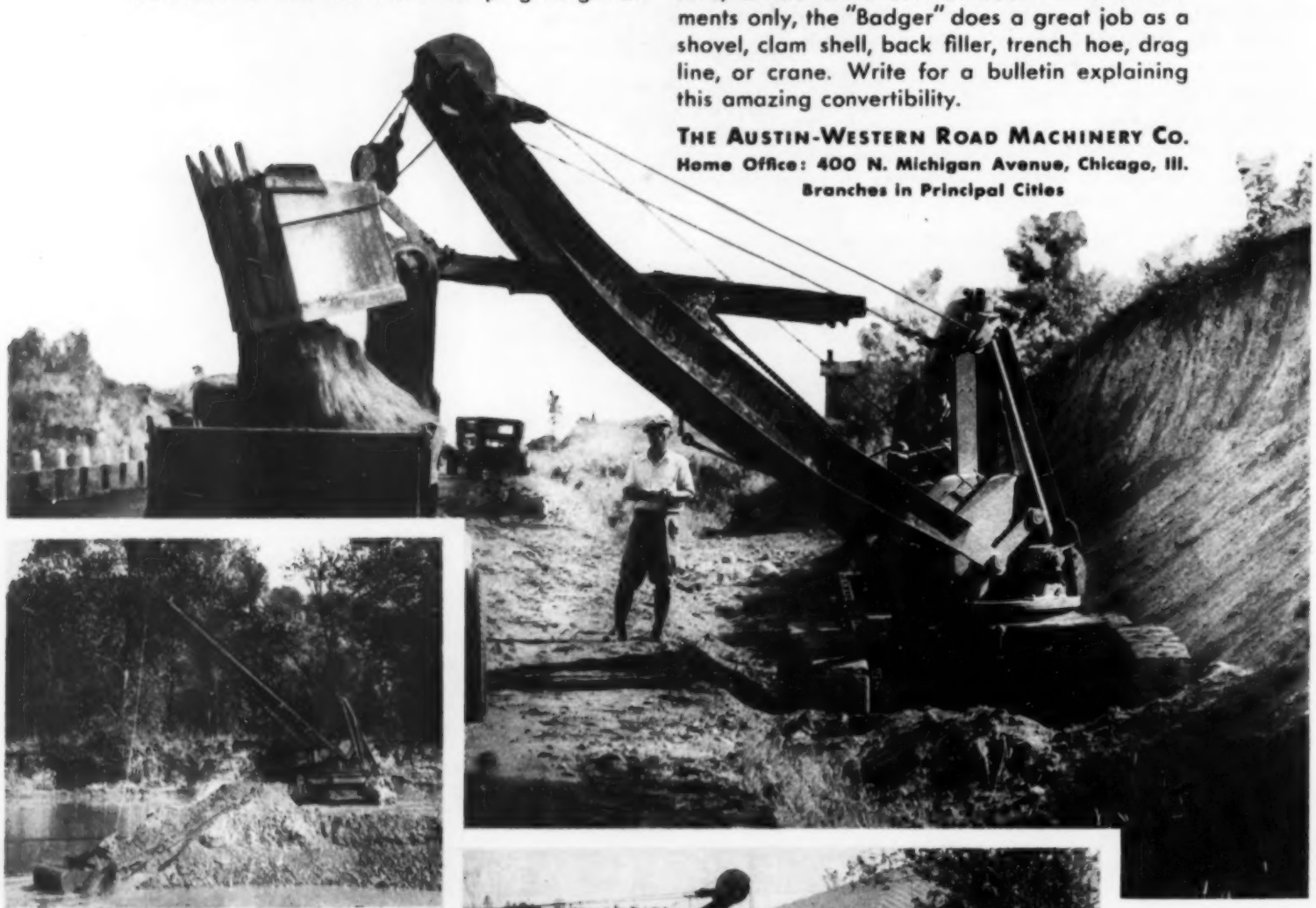

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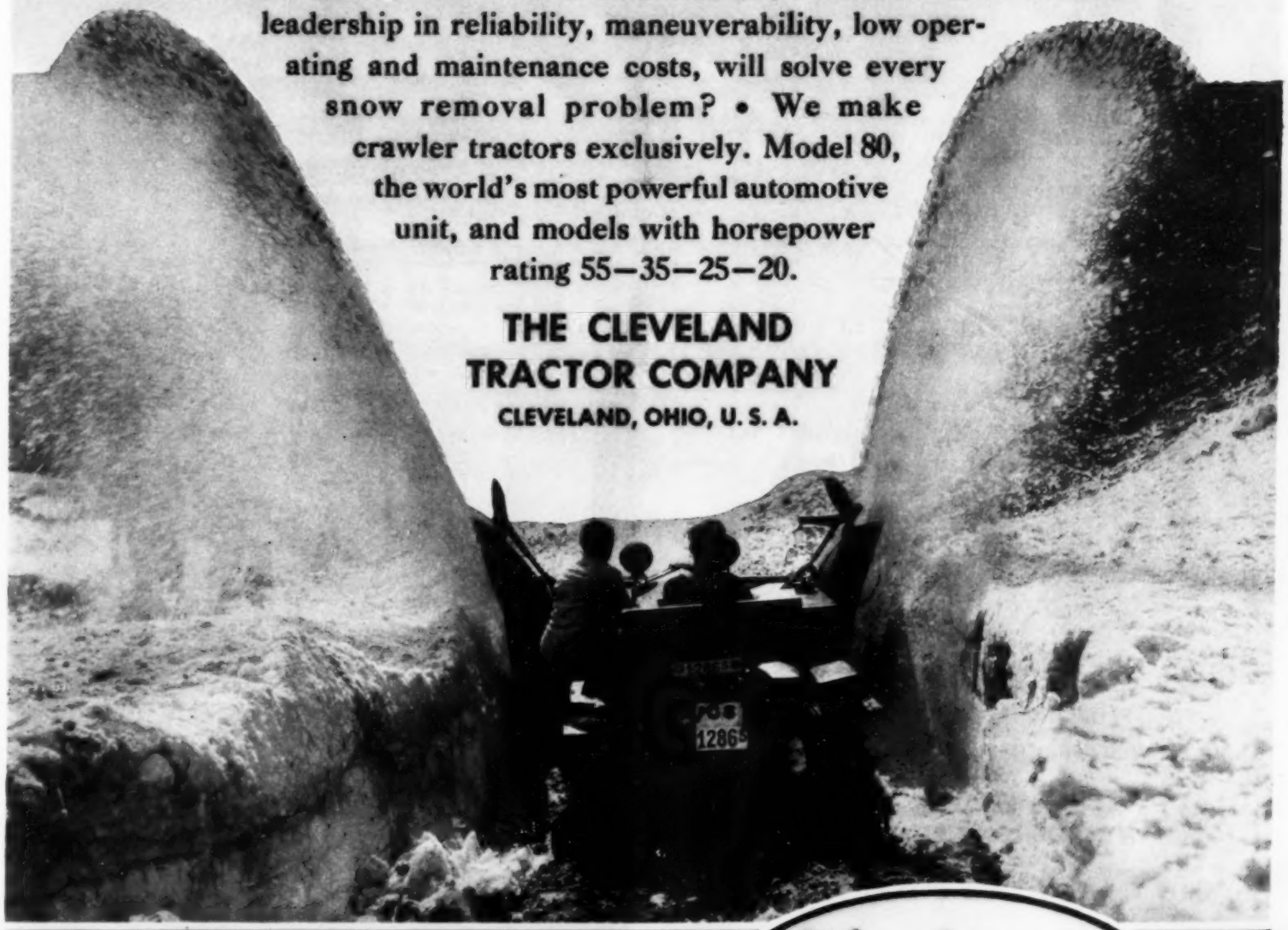

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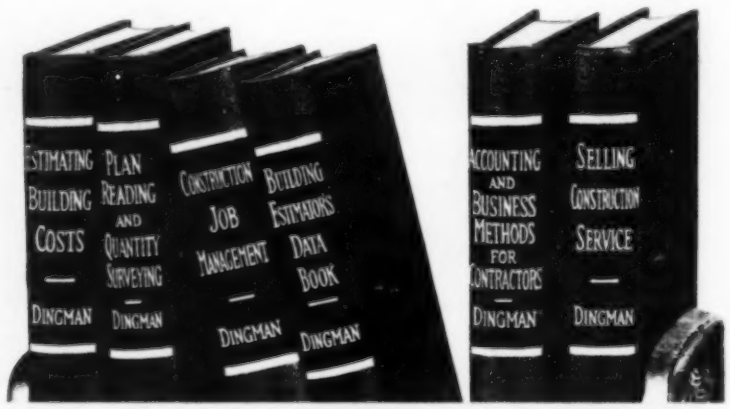

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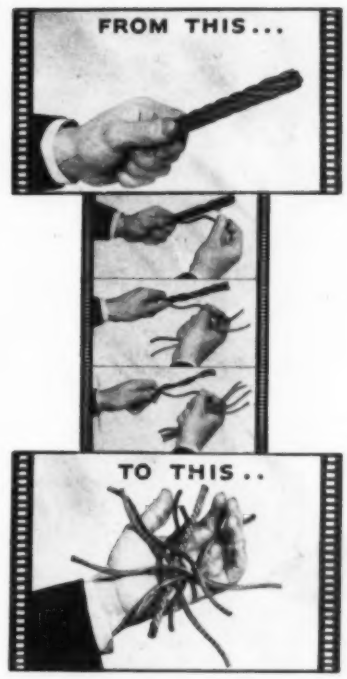

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